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VIEWS, NEWS AND INTERVIEWS.

Andrew Carnegie has promised to give $50,000 to Stevens Institute for a new engineering laboratory. Plans for the new building will be prepared at once. When completed the laboratory, it is expected, will surpass those of Cornell and Columbia and will equal that of the Massachusetts Institute of Technology, which is said to be the best in the country.

There are said to be about 15,000 telephone subscribers in Paris, France.

Pittsburgh gives substantial evidence of prosperity by the advance in wages which the Consolidated Traction Company of that city makes to its 1,000 employés. The advance is 11 per cent, while the men in the power-house get a reduction of hours without decrease of pay.

A German has obtained a patent for the process of manufacturing "Oxynaphtindophenolthiosulfuric acid." Infringers, take warning!

One of the causes of friction between the members of the Naval Board on Construction has been removed by an agreement of the board that all deck winches on war vessels, except battleships, shall be run hereafter by electricity. The question of the use of electricity for operating them on battle-ships will be taken up later. The Engineer Corps of the navy has insisted that the winches shall be run entirely by steam, and, in consequence of their determined attitude, the board got into a tangle. The question may seem of little importance to laymen, but it caused a great deal of trouble at the meetings of the board. It is to end such internal controversies that Secretary Long has appointed a board, with Assistant Secretary Allen as president, to harmonize the differences between the various naval bureaus in regard to work on the construction and repair of warships.

A regular army officer, who has just finished building a 30-mile military telegraph line in Arizona, writes to a friend as follows: "We try to adhere to up-to-date methods, and, while the attempts may be crude, we manage to get the electric spark flying along from one outlying post to another."

The cable between this country and Germany will be both commercially and sentimentally a new tie of no little strength between the two nations. As such it is cordially to be welcomed, observes the New York *Tribune*. The more such links there are, binding together the nations of the world, the better it will be. At the same time we should like to see some such ties between this country and its various outlying possessions, all touching nowhere but upon American soil.

There were 50 automobiles in line in the parade which took place in this city yesterday. It would be worth while to know what the horses thought of it all.—*New York Evening Sun.*

The steam railroad between Quebec and St. Anne de Beaupre, Quebec, is being converted to an electric system. The traffic of this road is unique in that it consists almost wholly of pilgrims to the shrine of St. Anne in the church at Beaupre.

The marriage of Miss Harriet Mumford Campbell and Mr. George De Bockton Greene, of the General Electric Company, took place at Schenectady, N. Y., on June 1. The bride is the eldest daughter of the late Douglass Campbell, author of "The Puritan in Holland and America," and the groom is the son of the late Capt. S. Dana Greene, U. S. N., who commanded the "Monitor" in her famous fight with the "Merrimac" after Worden was injured, and a nephew of Gen. Francis V. Greene, of New York. The maid of honor was Miss Maria Greene, and the groomsman was Mr. S. Dana Greene, of the General Electric Company, a brother of the groom.

Capt. George T. Tilly, of the signal corps, while repairing a cable recently at Escalante, island of Negros, in the Philippines, was captured by the natives and killed. He was a well known telegraph operator.

THE NEW YORK TELEPHONE COMPANY'S BRANCH EXCHANGE AT THE RECENT NEW YORK ELECTRICAL EXHIBITION.

The New York Telephone Company at the Electrical Exhibition.

One of the handsomest exhibits at the New York Electrical Exhibition was that of the New York Telephone Company, which is illustrated on this page. The exhibit consisted of a model exchange in operation. Thirty-two of the exhibitors were connected with a switchboard, shown in the illustration, and this was connected by means of eight trunk wires with the Eighteenth street exchange of the company. No less than 300 outward calls were indicated per day while the plant was in operation, and the service, which was furnished free to exhibitors and visitors by the courtesy of the telephone company, was a great convenience to those having business in Madison Square Garden.

Four of the standard types of silent telephone booths were shown in operation. As the exhibit was only a few feet from a large and powerful organ, and in the vicinity of several vigorous mechanical pianos, this feature was highly appreciated by those who desired to converse over the wires.

The installation was an example of the convenience of the private branch exchange in large business houses. It was conducted and operated just as such a local exchange is in the various installations already put in by this company. There are no less than 450 such private offices in New York city alone, ranging from 10 to 80 drops in the case of private subscribers, and as many as 120 drops at the Waldorf-Astoria Hotel. These are outside of the private service of the hotel and represent simply public telephones connected to the local exchange in the building.

The outfits furnished to exhibitors were of the type known as the "N. P." desk stands, and are very neat and convenient pieces of apparatus.

At the main entrance to the triangular space of the New York Telephone Company, between two piers, was suspended a large blue bell—the familiar sign of the Bell telephone wherever found. On this bell was

the legend picked out in small incandescent lamps: "Don't travel; telephone." It was said by those in charge that several visitors, presumably from the country, inquired what sort of a newfangled thing a "don't travel" telephone was. The exhibit was in charge of Mr. Samuel B. Brewster, who superintends the pay-station work of the New York Telephone Company in the boroughs of Manhattan and the Bronx.

MEANS OF ATTAINING SAFETY IN ELECTRICAL DISTRIBUTION.*

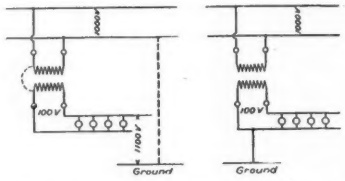
BY W. L. R. EMMET.

I have not selected this subject with the intention of fully discussing all its features, but rather for the purpose of bringing to the notice of this association certain matters of practical importance, concerning which radical differences of opinion exist among persons prominent in the electrical industry, and also for the purpose of pointing out some of the new problems which have been presented by recent developments of the electrical art, and which have not been fully considered in the adoption of the present standards of practice.

The persons most interested in the standardization of safe electrical methods are the fire underwriters; they have for years maintained a system by which statistics are carefully compiled and codes of rules adopted. These rules are revised from time to time, and their requirements in recent years have been nearly uniform all over the country. They have at different times been indorsed by this association and by other bodies representative of the electrical profession, and have, as a rule, been accepted as the standard by users of electrical apparatus. These rules are based upon experience gained from existing apparatus and methods, and, naturally, can not consider or provide for future possibilities, consequently they must be modified from time to time in order that the progress of the art may not be obstructed.

The principal sources of danger in electrical distribution are: First, heating of conductors by current; second, failure of insulation; and, third, arcing when circuits are intentionally or accidentally broken. Of the first of these causes of trouble very little need be said, since the standard system, by which a cutout protects every conductor, is an adequate safeguard, provided the cutout is capable of safely breaking any current to which it can be subjected. The second source of danger that has been mentioned is insulation, and this subject is one that must always receive much consideration, since the mechanical possibilities with available insulating substances are strictly limited, and since the sources of deterioration are many and difficult to avoid.

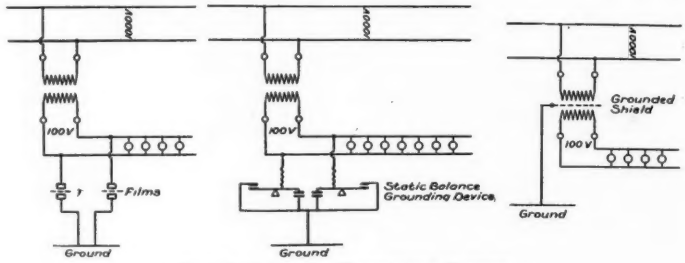
The best path to safety in electrical distribution lies in the avoidance of high-potential differences in places where life or property can be endangered. The difficulties of insulation increase very rapidly as the voltage is raised, and while it is possible to insulate for very high voltages, in small space in special cases, the difficulties multiply themselves almost in proportion to the square of the voltage increase. In electrical distribution there are two ways by which danger from high voltage can be avoided. First, by abandoning high voltage altogether, and, second, by providing means by which it can not exist on parts of the circuit where life or property can be endangered. We have good examples of the former of these methods in the large, direct-current, three-wire systems operating from generators with about 125 volts on a side. With this voltage the dangers from failure of insulation are very small, and I think that an investigation would show that most of the fires that have been caused by such systems have arisen from heating of conductors or failure of circuit-opening devices.



FIGS. 1 AND 2.—ELECTRICAL SAFETY.

The scope of such low-tension distribution is, of course, restricted, while the use of high voltages enables us to distribute over large areas with much greater economy and efficiency than is possible with low voltage alone. The desire to effect these economies has led in many places to the installation of high-voltage apparatus for supplying power to these same three-wire systems. The existence of these conditions compels us to look for means of securing safety where power is transmitted at high voltage. There is but one sure means of accomplishing this end, and that is by preventing the existence of the high potential on parts of the circuits where life or property can be endangered. We will consider some of the methods by which this end can be accomplished.

Fig. 1 shows the simplest arrangement of a primary and secondary circuit, as they are now generally installed in this country, and illustrates a condition under which this arrangement may become dangerous. The dotted lines show connections that may be accidentally made, one showing a cross between primary and secondary, either in the transformer or out of it, and the other, a connection of one of the primary leads to ground. The primary voltage being 1,000 and the secondary 100, the making of these connections immediately establishes a potential difference of 1,100 volts between part of the secondary circuit and the ground. This pressure will, as a rule, be too much for the insulation of combination fixtures, and the first indication of trouble is likely to be a fire, if it be not a shock received by some one who happens to establish a circuit through his body between the ground and some lamp socket or other part that is not sufficiently insulated from the secondary circuit. The method of installation shown in this figure is almost universally adopted wherever alternating currents are being used in this country. It is, in fact, virtually compulsory upon the average station manager, since no established method of overcoming the difficulty is available that does not violate the fire underwriters' rule that all house wiring shall be free from any connection to ground. If this rule is disregarded, we may adopt the arrangement shown in Fig. 2, which entirely overcomes the difficulty, and which is open to no objection except that the insulation between one side of the secondary and ground is subjected to the voltage of the secondary circuit.



FIGS. 3, 4 AND 5.—ELECTRICAL SAFETY.

With the arrangement shown in Fig. 1 it is quite possible that the secondary insulation may be subjected to a considerable part of the primary voltage, even when there is no ground connection on the primary circuit. The potentials on insulated circuits carrying currents tend by static induction to balance themselves with respect to the ground, so that the potential of the ground is normally neutral to that of the two conductors. Where circuits are long, and operate at high potentials, a considerable flow of current between one conductor and ground may be required to materially disturb this neutrality. This has been illustrated to many of you by the lighting of ground-detector lamps from circuits that are perfectly insulated. When a secondary becomes crossed with a perfectly insulated primary, these static-capacity currents tend to flow to ground through the secondary insulation. We know by experience that under the most ordinary conditions on 2,000-volt circuits these currents are of sufficient volume to light ground-detector lamps, and we know that almost any current of ordinary potential transmitting power enough to light a lamp may, under certain conditions, cause a fire.

So long as the secondary circuit remains insulated from ground, these dangers will exist. The remedy for the trouble must be either in the permanent connection to the ground, as in Fig. 2, which is now prohibited by one of the underwriters' rules, or in the installation of some device by which the secondary is grounded automatically when the emergency arises. Figs. 3 and 4 show methods used to accomplish this purpose, and Fig. 5 shows a method for preventing contact between primary and secondary of a transformer by the introduction of a grounded shield, which has been used to some extent, with a view to avoiding the danger above described.

The objections to this method are: First, that it affords no protection against crosses between primary and secondary which may occur outside of the transformer itself; second, that it introduces expense, since the shield must be made heavy enough to carry current sufficient to blow the primary fuses, and at the same time must be so arranged that it will not introduce serious eddy-current losses, and, third, that it probably renders the transformer more subject to injury from lightning.

Fig. 3 shows the secondary separated from ground by films of insulating material, which are intended to puncture when the voltage to ground rises above a certain point. The objection to this method is that the films are likely to be uncertain and variable in their insulating qualities, and may, under certain conditions, be punctured by the secondary pressure.

Fig. 4 shows the same object accomplished by means of static balances, whose motion, by rise of potential difference, causes the circuit to be grounded. Another device has been suggested in which a magnet is placed in series with a vacuum tube between the secondary and ground. When the potential difference rises, the discharge through the tube is increased, and the magnet starts mechanism which grounds the secondary circuit. The objection to these devices is that they are not perfectly instantaneous in their action, and that the secondary insulation may break down elsewhere before they accomplish the desired result. They are also more or less complicated and liable to fail on that account.

As I have said, the permanent grounding of transformer secondaries is prohibited by the fire underwriters'

*A paper read before the National Electric Light Association, New York, May 24, 1899.

rules, which prohibition is generally respected throughout the country, so that most secondary circuits are entirely unprotected from the trouble above described. There are, however, some very important exceptions that afford useful examples of the

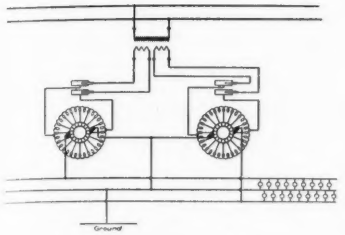


FIG. 6.—ELECTRICAL SAFETY.

safety of operating secondary circuits with permanent ground connections. I allude to some of the large Edison companies which have recently installed high-tension alternating apparatus to supply power to existing three-wire systems through rotary converters. In a rotary converter the collector rings and commutator connect to the same winding, so that the direct-current leads are as much a part of the transformer secondary system as if they were connected directly to it. Most of these large Edison companies have for years been operating with neutral conductor grounded. This grounding has in most cases first occurred through chance or accident, and the practice has been persevered in, partly because it would be a difficult matter to avoid neutral grounds, and partly because the grounded neutral is, for several reasons, very desirable

Fig. 6 shows the condition existing in such cases. In these cases two

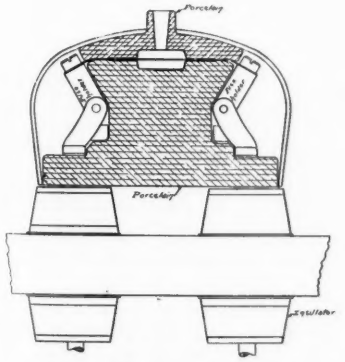


FIG. 7.—ELECTRICAL SAFETY.

rules of the National Board of Fire Underwriters are violated: First, the secondary system to which all house wiring is connected is permanently grounded; and, second, a primary voltage of 6,000 is used, while the underwriters' rules state that house wiring must not be connected to the secondaries of transformers whose primaries receive current at voltages above 3,000 In spite of these violations, the circuits are just as safe as they were before the high-tension power was used, and safer than they were before their neutrals were grounded, although at that time no high-tension apparatus had been installed. Both of these rules should, and in time will, be abandoned; the first, because it leads to danger rather than safety; and the second, because it endeavors to fix an unnecessary barrier to progress. The interests of insurance companies, as well as of users and manufacturers of electrical apparatus, are best served by the introduction of methods which conduce to economy in the broadest sense.

A forcible illustration of the danger of ungrounded secondaries is afforded by a recent occurrence in New Orleans. In a certain residence district, where houses were connected to a system of three-wire alternating mains, a cross caused by wind occurred between one of the main wires and a 2,000-volt primary wire in the same street. The result was that the insulation between wiring and ground was broken down in a large number of houses, the trouble being principally in combination fixtures where conductors were near gas-pipes. Fires occurred in 20 houses and several were totally destroyed, among which were some fine residences. The loss was over $200,000. If the neutral of this system of mains had been grounded, this trouble could not have occurred.

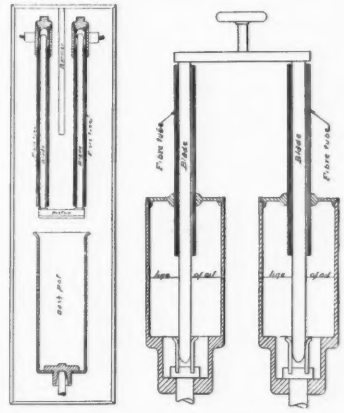
There is but one condition necessary to safety with a properly grounded secondary; namely, that there be no possibility of the accidental introduction to the secondary system of sufficient primary current to blow the secondary fuses. No possible set of conditions can arise where this precaution can not be provided, since portions of primary circuits occupying the same streets with secondary mains can easily be protected by fuses, if the total primary current capacity exceeds that of the fuses of the secondary mains in question.

One of the reasons why this subject has not come into prominence before, is that systems of alternating secondary mains have not been much used till quite recently, and, consequently, the possibility of crosses between primary and secondary wiring in streets has not existed.

The rule of our underwriters which prohibits the grounding of secondary wiring is not supported by the practice of other countries. I am informed that in England and on the continent, secondaries are very generally either grounded or protected by some such automatic devices as I have described. The prejudice against grounded circuits in buildings has always been very strong in this country, and in my opinion has been carried to unreasonable lengths. Grounded circuits of moderate potential can, with very simple precautions, be installed in buildings with perfect safety.

The third cause of danger in electrical distribution, which I have mentioned, is arcing through accidental opening of circuits or through failure of circuit-opening devices. Fuses, switches and circuit-breakers are subjects upon which a great deal could be said in discussing means of attaining safety. Many of the circuit-opening devices that have been introduced in the past have been capable only of breaking certain definite currents, and incapable of coping with the conditions existing when a very large system is short-circuited. Most of the switchboard devices that are now in use for alternating work are strictly limited in the range of their safe action, and would be valueless on a circuit capable of delivering a large amount of power.

In the past, alternators have been generally used singly and in comparatively small units, the total power that could be delivered to one point being limited to the maximum output



FIGS. 8 AND 9.—ELECTRICAL SAFETY.

of one machine. In many of the installations now being made, numbers of large machines are being run in parallel, and the power that can be delivered at any point is consequently large, and the difficulty of breaking the current that flows in case of short-circuit is correspondingly great.

In the new station of the Metropolitan Railway Company about 50,000 kilowatts will be delivered to a single set of bus-bars, and from there distributed all over the city. Wherever a substation or other installation is connected to these lines, means must be provided by which the circuit can be broken instantly in case a short-circuit occurs. The power of this station is generated and distributed at 6,000 volts, and the loss in lines will be small, so that the violence of a short-circuit in a substation will be almost as great as if it were on the main bus-bars.

We have recently done a good deal of work on circuit-opening devices for such heavy duty. One of the principal troubles in such work is the difficulty of making experiments. We have a testing outfit at Mechanicville with which we can get from 300 to 400 amperes at 15,000 volts with an inductive load, and at Niagara Falls I have tested some devices with 700 amperes and 13,000 volts and a highly inductive load, the voltage rising to 18,000 when the circuit was opened. In comparison with past experiences these conditions seem heavy, but they are light when compared to those which must be met in some plants that are now being installed.

There is, of course, a limit to the capacity of every circuit-opening device, and as power units become enlarged it will be necessary to provide means for limiting the total amount of power that can be delivered to individual branches. This object can be accomplished by inserting reactances in these branches; such reactances can be so proportioned that they do not materially interfere with the normal operating conditions, and, at the same time, they can so limit the total power delivered that it is kept within the safe range of the circuit-opening devices. Up to the present time, such reactances have not been much used. Their introduction naturally somewhat affects voltages, and for this reason may be considered undesirable. By judicious arrangement and proportioning, the objections can, to a great extent, be overcome, and there is little doubt that such devices will be much used in the future.

I have prepared sketches of a few circuit-opening devices that have resulted from recent investigations and experiments, and will briefly describe their design.

Fig. 7 shows a fuse block in which the fuse is in a state of tension between two hinged terminals; these terminals are pulled apart by springs and receive current through flexible connections. The fuse is punched out of sheet metal, the narrowest portion being at the middle. It is placed between two blocks of porcelain, a small amount of clearance being provided where the fuse passes through, so that its ends can be freely withdrawn by the movable terminals after the narrow part of the fuse has become ruptured. Around

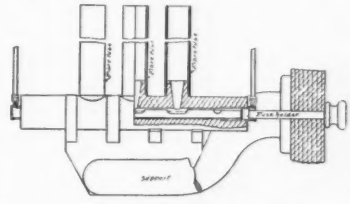


FIG. 10.—ELECTRICAL SAFETY.

the narrow part of the fuse the porcelain blocks are recessed so as to provide an air chamber; this chamber is vented by a hole in the upper block. The whole device is firmly clamped together, so that the only opening to the outer air is through this one vent-hole. The fuse, being under tension, does not quite reach the melting point before the break occurs. It loses its tensile strength at a low red heat and pulls apart. It is quickly withdrawn by the springs from the air chamber in which it has been broken. A very small amount of the metal is volatilized and its gas is blown out of the vent-hole. For the purpose of preventing any deposit of metal fumes on the porcelain surfaces,

(Concluded on page 362.)

SCIENCE BREVITIES.

Electric Treatment of Gout—Mr. Fournier d'Albe makes the following abstract of a recent communication to the Académie des Sciences: If gout is an auto-toxication due to retardation of nutrition and consequent alteration of the tissues, especially the joints, any measure which increases the local nutrition must have some prospect of being beneficial. Such measures must aid the tissues in carrying the nutritive process to its legitimate stages without producing intermediate products which are insoluble in the organic media. They must also tend to eliminate the urates and other products already deposited, and thus restore the member to its healthy condition. T. Guilloz has achieved good results by the electrolytic transport of lithium across the affected joint. He employs strong currents, reaching 150 or even 200 milliamperes, and passes them for 20 or 30 minutes. If the bones are not suffering from chronic osteitis, there is a rapid diminution of pain and a permanent improvement in the condition of the joint. At the same time there is a reaction upon the general nutrition; it is accelerated, and, in the case of obesity, tends to a decrease in weight. The author has applied the same treatment to chronic rheumatism, but without obtaining any satisfactory results. The cure should be combined with D'Arsonval's system of "auto-conduction."

Magnetic Observatories and Electric Traction—From all sides, says *L'Electricien*, there comes up a wailing about the trouble in which the magnetic observatories find themselves on account of the spread of electric traction. Herr von Bezold, of the Prussian Meteorological Institute, has just been explaining that electric railway lines within 10 miles of magnetic observatories render the observations of the latter inaccurate. A recent Swiss commission, appointed to make a magnetic survey of their country, fixed, however, upon the limit of three and one-quarter miles. M. Hepites, the director of the Roumanian Meteorological Institute, has lately made a large number of observations around Bucharest. At a distance of three miles absolute determinations of terrestrial magnetic force were possible, but the influence of the railway upon registering instruments was distinctly noticeable. The question of the shifting of magnetic observatories from these influences is one of the highest importance, because of the scientific and practical value of the study of terrestrial magnetism. Navigation is practically dependent upon charts of magnetic deviation, and as this is constantly changing, it is of the first importance that accurate work shall constantly take place. It seems rather as if the magnetic observatories would have to take to the woods. Those in the vicinity of Boston and Montreal have practically been abandoned. It may be when that happy day comes, when all the trunk line railways are operated by electricity, that the magnetic observatories will have to be towed out to sea beyond soundings, and anchored somewhere out of the range of the insidious return current.

Wireless Telephony—Señor Manuel Maluquer contributes to the *Revista de Obras Publicas* a rather fanciful communication, in which, after reviewing the photophone, the Marconi and other wireless telegraph systems, he allows his imagination to suggest several methods of wireless telephony. It is well known that, under a given electrical pressure, the effect of ultra-violet light following upon a spark-gap is to increase the ease with which the sparks leap it. This effect may also be secured by reducing the pressure of the air or other gas surrounding them. The author supposes that a telephone transmitter is connected, either in shunt or series, with an interrupted circuit in which the speed of interruption is higher than the limit of audition, say, 80,000 vibrations per second. In this circuit is the usual spark coil, connected with a Righi oscillator or other similar apparatus. By using ultra-violet light the energy required to work down the spark-gap can be made small, and the telephonic vibrations, being comparatively slow, can be superposed upon those due to the circuit-interrupter. Another method of accomplishing the same result would be to vary the ultra-violet radiation following upon the spark-gap in the same way that the photophone transmitter is made to operate. For a receiver the author suggests a plate of glass, having upon its surface fine crystals of silver which are almost, but not quite, in molecular contact with one another. Under the influence of the electrical vibrations small sparks will burst across these, and if this plate is made the base of a cone filled with air, the ear will be able to detect the passage of the small sparks by the consequent heating of the air compound. Here, according to the author, are all the elements for a wireless telephone system which ought to work. Speaking about the possibility of superposing the telephonic vibrations upon the much finer alternations which he presupposes, the author says: "The acoustic effect would hardly be different from the visual effect of a drawing made upon porous paper." He also suggests the use of the ultra violet light to make his receiver more sensitive, and calls attention here to the curious fact that the effect of the coherent action taking place in this would be to cause reflected light from its surface to become alternately polarized and depolarized, and that this with the aid of suitable apparatus, unnecessary to describe, can be used in connection with the Bell photophone receiver to gather in the voice vibrations. The whole subject is one of extreme interest, and underlying the fancies of Signor Maluquer, more ingenious and interesting than practical, there may be the elements for scientific work of vital importance within the next few years.

Luminosity of Rare Earth—At a recent meeting of the Royal Society, Lord Kelvin communicated a paper on the "Luminosity of the Rare Earths when heated in vacuo by means of Cathode Rays," by A. A. Campbell Swinton. For incandescent gas mantles it is found that certain definite mixtures of the rare earths are necessary in order to obtain the maximum luminosity. For instance, a mantle consisting of pure thoria or pure ceria will in the Bunsen flame only give about one-eleventh of the light of one composed of 99 per cent of thoria and one per cent of ceria, which is the mixture used by the Welsbach company. In order to explain this remarkable fact, several contradictory theories have been propounded, and with a view to elucidating matters the author made experiments in which mantles composed of different pure oxides and mixtures were heated by cathode-ray bombardment in vacuo. The mantles were prepared according to the ordinary Welsbach process, and in order to obtain accurate comparisons the mantles were made in patchwork, each complete mantle being made up of two or four sections separately impregnated with different solutions. The mantles were so mounted in the vacuum tube that the cathode rays impinged equally upon the portions that consisted of different oxides and mixtures, so that an equal amount of energy was imparted to each sample. Under these conditions the Welsbach mixture of thoria, plus one per cent of ceria, was found to give very little more light than pure thoria, the difference probably not exceeding five per cent, but on starting the cathode discharge the mixture heated up to incandescence more rapidly, and on stopping the discharge cooled more rapidly than the pure thoria. At the same time it was found that, with an intensity of cathode rays that gave a brilliant light both with pure thoria and with the Welsbach mixture, a mixture of 50 per cent thoria and 50 per cent ceria, and also a piece of mantle composed of pure ceria, gave practically no light, becoming barely red hot. The maximum luminosities could only be obtained at a critical and highly unstable degree of vacuum, which rendered accurate photometrical measurements impossible; but with pure thoria the amount of light under favorable conditions was estimated at at least 150 candle-power per square inch of incandescent surface, this being obtained with an expenditure of electric energy at about 8,000 volts pressure of, approximately, one watt per candle. The cathode rays were found to have a reducing action on the oxides, which became discolored under the bombardment, the discoloration disappearing owing to reoxidation on the admission of a small quantity of air. Air so admitted while the tube was working was rapidly absorbed, and after the process of admitting air and absorbing it had been repeated several times, the degree of exhaustion which gave the maximum incandescence was found to have altered considerably, the residual gas having apparently become less conducting. In place of air, oxygen and hydrogen were separately used as the residual gas, but without any difference in the luminosity. These experiments show that thoria and ceria, both alone and mixed, behave quite differently when heated by cathode-ray bombardment than when heated in a Bunsen flame. In the latter, thoria, plus one per cent of ceria, gives many times as much light as pure thoria alone, while, when incandesced by cathode rays of equal intensity, the difference, though in a similar direction, is only just appreciable. Again, in the flame pure ceria gives just about the same amount of light as pure thoria, while, with a given intensity of cathode-ray bombardment, thoria gives a brilliant light, while ceria gives practically none. In arriving at any satisfactory theory of the luminescent properties of the rare earths, these results will have to be taken into account.

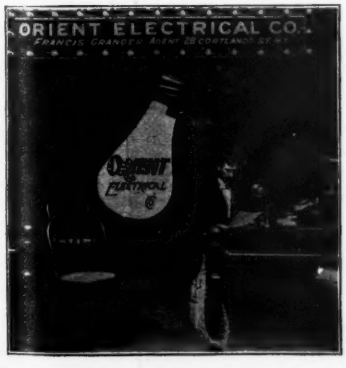
SOME NOTABLE EXHIBITS AT THE RECENT NEW YORK ELECTRICAL EXHIBITION.

HANDSOME AND INSTRUCTIVE DISPLAYS OF ELECTRICAL METHODS AND MANUFACTURES.

The American Vitrified Conduit Company made an attractive display of its various forms of conduits, ducts and other fittings for underground electric work. A subway system was mapped out in full scale, showing a manhole built with a new type of bricks and having a special arch cover, which was closed with the McGregor noiseless manhole frame and lid. Extending from this manhole were lines of single, two, three and multiple duct sectional conduit, including types of distributing boxes, etc. The exhibit was arranged in a practical and satisfactory manner and attracted no little attention from visitors who were interested in underground work.

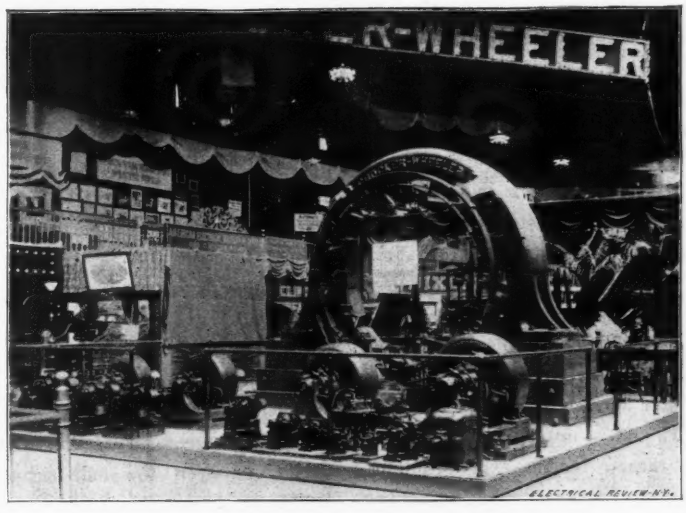
THE NEW YORK ELECTRICAL EXHIBITION—THE AMERICAN VITRIFIED CONDUIT COMPANY'S EXHIBIT.

The Orient Electrical Company, of Youngstown, Ohio, supplied nearly all the sign lamps used in the Garden. Their booth was marked by one of the most striking electrical signs in the exhibition—a large board in the shape of an incandescent lamp carrying on its face the word "Orient" in small colored lamps. This company makes a specialty of manufacturing colored lamps and small lamps for sign work. Mr. A. H. Granger, of the New York office, was in charge of the booth.



THE NEW YORK ELECTRICAL EXHIBITION—EXHIBIT OF THE ORIENT ELECTRICAL COMPANY.

The Crocker-Wheeler Company, New York, made a very complete and instructive display of dynamos and motors, as the illustration herewith clearly shows. No less than 15 sizes of motors were exhibited, together with many rheosats, controllers, etc. In the middle of the space stood the field ring of a 400-kilowatt machine, one of several built for the Smelting Corporation, Limited, of London, England. This 14 ton field-ring was the largest single piece of electrical apparatus exhibited at the show. A compact motor dynamo, for direct-current transformation between 110 and 375 volts, was shown in one corner of the exhibit. Messrs. Blackall and Baldwin, assisted by several gentlemen of the New York office staff, were in charge of the exhibit.



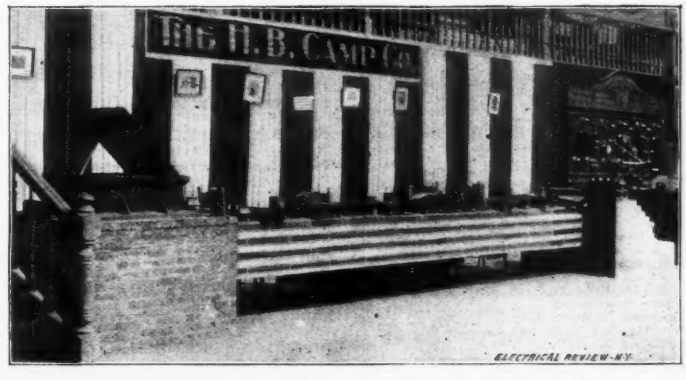
THE NEW YORK ELECTRICAL EXHIBITION—THE CROCKER WHEELER COMPANY'S EXHIBIT.

In Messrs. Machado & Roller's booth there was a handsome board of Whitney instruments, ammeters, voltmeters, etc., and a new security fog signal, manufactured by the New Jersey Valve Company.

A very striking exhibit was made by the Stanley Electric Manufacturing Company, Pittsfield, Mass., and the Stanley Instrument Company, Great Barrington, Mass., conjointly. The former company showed a number of elaborate switchboard fittings adapted for high-tension work, transformers, etc., and their new types of hot-wire ammeters and voltmeters. These instruments are of the portable type, and are finished in a handsome and serviceable manner. The remarkable and interesting wattmeters shown by the Stanley Instrument Company were described at length in the ELECTRICAL REVIEW last week.

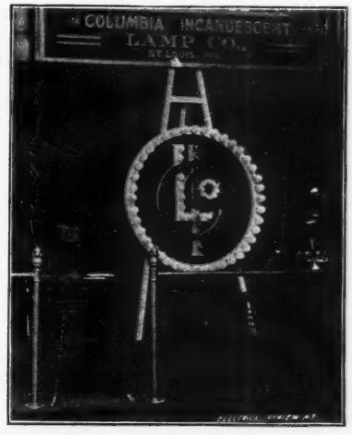
The S. S. White Dental Manufacturing Company, Philadelphia, showed a large number of surgical and dental instruments with electrical attachments, among the latest being cauteries, mallets and mouth-illuminating lamps. The Excello battery cell, which is manufactured by the Burnham Electric Company, Boston, was also shown operating a fan motor.

The Morris Arc Lamp Company, Chester, Pa., exhibited several styles of long-burning enclosed direct-current arc lamps for operation on constant-tension circuits. These lamps, which are very simple in construction and adapted to 110, 220 and 500-volt circuits, were shown in operation by Mr. Miller, who had charge of the company's exhibit.



THE NEW YORK ELECTRICAL EXHIBITION—THE H. B. CAMP COMPANY'S EXHIBIT OF UNDERGROUND CONDUIT.

Perhaps the most striking feature about the Columbia Incandescent Lamp Exhibit—one of the three made by R. B. Corey, of New York—was the handsome illuminated sign in the shape of an easel, which is well shown in the accompanying illustration. In front of the booth was a show-case containing one of the most attractive small exhibits at the show. Here were shown incandescent lamps and filaments in all stages, from the raw materials to the finished product. The strength and elasticity of the Columbia filaments in the completed condition could well be understood by handling them. Mr. Oscar Hoppe, who has had an experience of many years in handling Columbia lamps, was in charge of the exhibit.



THE NEW YORK ELECTRICAL EXHIBITION—A PART OF THE COLUMBIA INCANDESCENT LAMP COMPANY'S EXHIBIT.

The H. B. Camp Company, of Aultman, Ohio, exhibited vitrified clay conduits and made a remarkable showing of its sectional conduit. A 16-duct section of this, 20 feet long, was laid, as the illustration shows, between two manholes, and was self-supporting throughout this entire length. A large number of specimens of single and multiple duct conduit and other underground fittings in vitrified clay were shown. Mr. Louis W. Camp, the son of Mr. H. B. Camp, had charge of the exhibit.

Electrical Review

OLDEST ELECTRICAL WEEKLY IN THE UNITED STATES.

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News, Subscriptions and Advertisements.

SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.
NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week, although it is occasionally possible to get in matter received on Monday.

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COMPRESSED-AIR FALLACIES.

Ever since the application of compressed air for working drills in the Mount Cenis tunnel, 20 odd years ago, there has been a periodical exploitation of the merits of this motive power for the operation of street railway cars. Its promoters have urged a variety of arguments favoring its use, and numerous experiments have been made with it, but the fact that to-day, after all the futile years of experiment and the great sums spent in attempts to perfect compressed air traction, not one single line of such cars is in commercially successful operation, is the strongest evidence against its practicability.

Still, the arguments are so often repeated, the experiments so frequently retried, the faith of the exploiters so strong, that it is worth while occasionally to examine the claims of this system in order to point out anew their fallacies and the difficulties and dangers surrounding the operation of street cars by highly compressed air. While it may be fairly apparent that compressed air cars are not destined to play any important part in street railway affairs, the unending agitation of the subject may mislead the public into the belief that such machines are practical and successful, whereas their history is one long record of failure. New York city is, unfortunately, the present theater for the exploitation of a system of this character, and experiments with it and the extravagant claims made for it may even have delayed the equipment of important lines with electricity.

It will be conceded that the first essential to a successful system for passenger transit is safety for the passengers. After this come reliability, economy and general desirability on æsthetic and other grounds. It hardly can be contended that drawn-steel flasks filled with compressed air at about 2,500 pounds per square inch pressure are safe traveling companions. In the cars now being provisionally operated in New York there is, in addition, a tank of hot water, under about 210 pounds steam pressure. In case of a collision or accident the passenger who escapes being blown to atoms risks being scalded to death. The choice between these methods of making one's departure is not very attractive.

Further than this, the very fundamental nature of the process of comparatively isothermal compression is wasteful of energy. Energy must again be given the air by "reheating" before it is allowed to do work, otherwise the efficiency of the operation is ridiculously low, and the engines become refrigerating machines, their temperature falling to such a point that lubrication is difficult, if not impossible. The engine itself is full of reciprocating parts, necessarily running at a high speed. And added to all this is the noise of the exhaust.

In certain fields, for the operation of mining drills, of certain machine tools, for applying brakes on railway trains, etc., compressed air has a restricted but legitimate usefulness, and has been an important industrial factor. The street railway, however, is not numbered among the useful applications of this agent for the reasons given above and many more.

But it is unnecessary to go into details. The fact that, after more than 20 years of experiment, there is no line of railway commercially operated by compressed air cars, is, in itself, sufficient to show that this system can not compete with electricity, cables, or even the half-forgotten horse.

THE ELECTROMOBILE.

Our name contest, instituted for the purpose of giving a proper appellation to the electrically propelled vehicle for highways—that unchristened product of latter-day engineering—has resulted in the choice of the singularly euphonious term "Electromobile." It is true that this is a mongrel word, but the fact that a word is of doubtful parentage has never kept it from being adopted into the English tongue. This word has two great merits—it is easy to pronounce, and it can be easily shortened into "electro" or "mobile."

The committee, for whose interest in the matter and labor in considering several hundred names the ELECTRICAL REVIEW is most grateful, took into consideration rather the availability and probable usefulness of the words submitted than their etymology. Their purpose was to provide the vehicle with a name that would be acceptable to the mass of the English-speaking people. It is earnestly to be hoped that the name they have chosen out of so many will be used, and that we will not again see in print the uncouth misnomers that have burdened the electromobile until now.

It is a curious fact that lightning rarely does much damage in large cities. That this is not immediately due to the many metallic structures is proven by the fact that the few bolts which actually strike rarely seek the steel skeleton buildings; they more often strike some modest chimney or tree. It is strange that so very little is known to-day of lightning—unquestionably the first electrical phenomenon ever observed. It is true, though, that knowledge of it is limited almost to a record of observation, no entirely satisfactory explanation of the accumulation of lightning potentials or the action of the discharge itself having yet appeared.

The third electrical exhibition, held at Madison Square Garden, New York city, under the auspices of the National Electric Light Association, closed its doors last Saturday evening after a month's successful run. There was much on view to interest the electrical fraternity and a great many exhibits of an educational value to the general public. At this exhibition was shown the largest collection of electromobiles ever gathered together in the United States. This feature, in connection with the splendid electromobile parade, will mark the exhibition just closed as an historical event. We believe that from a financial standpoint the affair was a success. The gentlemen interested in the electrical exhibition are to be congratulated on the result of their labors.

"ELECTROMOBILE"

The Winning Name in the "Electrical Review's" Prize Contest.

REPORT OF THE COMMITTEE COMPOSED OF MESSRS. BLIZARD, DUNCAN AND CARTY.

NAMES OF THE SUCCESSFUL COMPETITORS.

In its issue for April 19, 1899, the ELECTRICAL REVIEW announced that it would give prizes for the best names submitted by its readers to designate "the electrically propelled, self-contained vehicle for roads and streets." The contest closed on May 27, and the prizes offered were as follows:

First prize, $10 and one year's subscription to the ELECTRICAL REVIEW.
Second prize, $5 and one year's subscription to the ELECTRICAL REVIEW.
Third prize, one year's subscription to the ELECTRICAL REVIEW.

The names submitted were carefully considered at a meeting held on June 5, by a committee composed of Dr. Louis Duncan, chief engineer of the Third Avenue Railway Company and for many years at the head of the electrical engineering department of Johns Hopkins University; Mr. J. J. Carty, chief engineer of the New York Telephone Company, and Mr. Charles Blizard, New York manager of the Electric Storage Battery Company.

The committee has made the following report to the ELECTRICAL REVIEW:

TO THE EDITOR OF ELECTRICAL REVIEW:

Your committee has met pursuant to the terms of the name contest, as published in the ELECTRICAL REVIEW for April 19, 1899, which were as follows:

The electrically propelled, self-contained vehicle for roads and streets lacks a name. Since its appearance as a familiar object in the streets it has been saddled with a variety of designations, some too long, some meaningless, all unsatisfactory. . . . In order that this last development of electrical engineering shall no longer suffer under many aliases, the ELECTRICAL REVIEW has determined to offer prizes for the best name for it, and invites its readers to compete. Anybody can enter the lists, and all suggestions will be welcomed. . . .

The committee has considered the list of names submitted, from which it has selected for first prize the word

ELECTROMOBILE,

suggested by Mr. Elias E. Ries on April 20, 1899.

The second prize is awarded to Mr. S. A. Douglas, who also sent in the word "Electromobile," but at a later date, April 21, 1899.

The third prize is awarded to Mr. Joseph A. O'Donaghue for the word "Electricmobile," received on May 10, 1899.

Inasmuch as, according to the terms of the contest, the idea of a self-propelled vehicle must be contained in the successful word, it might be thought that this idea was absent from the word "electromobile." The committee is of the opinion, however, that in consequence of the place which the word "automobile" has now obtained in our language, and in consequence of the suggestion of that word contained in "electromobile" this condition of the contest is complied with.

Respectfully yours,
CHAS. BLIZARD, Chairman,
LOUIS DUNCAN,
J. J. CARTY.

New York, June 5.

LETTERS FROM CONTESTANTS.

The communication from the winner of the first prize, Mr. Elias E. Ries, was the second one received in the contest and arrived at the ELECTRICAL REVIEW office at 5.20 P. M., on April 20, 1899. It is in full as follows:

TO THE EDITOR OF ELECTRICAL REVIEW:

The writer respectfully suggests the term "Electromobile" as a universal name for electrically propelled, self-contained vehicles adapted for use on ordinary streets and highways. This term will lend itself readily to the diminutive and more generic expression "Mobile," should the electric road vehicle sufficiently supersede its would-be rivals to warrant the dropping of the prefix "electro."

The prefix "auto" as used in "automobile," "automotor," etc., is, strictly speaking, incorrect as well as superfluous and therefore objectionable, beside which it does not distinguish between road vehicles propelled by electric and those operated by compressed air, petroleum or other power.

The suffixes "vehicle," "carriage," "car," "cab," "wagon," etc., in addition to being specific terms, are peculiar to the English language and are not therefore of sufficient universal application. On the other hand, the expression "mobile" which is common to the English, French, German and other languages, signifies something active, movable, free and changeable, and is thus well fitted to designate the qualities and to stand as the name for a self-propelled vehicle that is not confined to a rigid line of way.

Yours very truly,
ELIAS E. RIES.

New York, April 20.

The letter from Mr. S. A. Douglas, the winner of the second prize, who also submitted the word "Electromobile," was received at the ELECTRICAL REVIEW office on April 21, 1899, at 3 P. M.

Mr. Joseph A. O'Donaghue, who was awarded the third prize for the suggestion "Electricmobile," wrote from San Francisco, Cal., on May 2. His letter was received by the ELECTRICAL REVIEW on May 10, 1899, at 9.10 A. M.

The following very interesting communication was received on May 25:

TO THE EDITOR OF ELECTRICAL REVIEW:

I learn from the pages of the *Autocar* of the 13th inst. that you are anxious to obtain suggestions for a new nomenclature better adapted to the description of self-propelled vehicles, and of electrically driven carriages in particular.

I am unaware of the conditions of the competition which you have opened, but it seems to give me an opportunity of bringing under your notice some proposals concerning this question which I have more than once urged in this country.

Such terms as autocar, motor car, and their cogeners are obviously unsatisfactory—hybrid in etymology—and, so far as they convey any meaning capable of being universally understood, of very limited application. In other words, they are not root-words from which can be conveniently and consistently derived the various subsidiary and compound terms which the growth of their central idea demands in practical use. That terrible and too popular term "automobile" is even worse, a peculiarly cumbersome and misshapen Greco-Latin bastard, seeking Anglo-Saxon naturalization.

I submit that the difficulty is by no means insuperable, if we will but begin and proceed upon the lines which have proved both successful and understandable in other cases; and that it is quite possible to devise a word which shall be simple in derivation, self-explanatory in use, and capable of being easily modified along simple and legitimate lines so as to accurately and efficiently express the various sub-meanings which are called for in relation to the different methods of propulsion, and the different forms of action, active and passive, required in different cases.

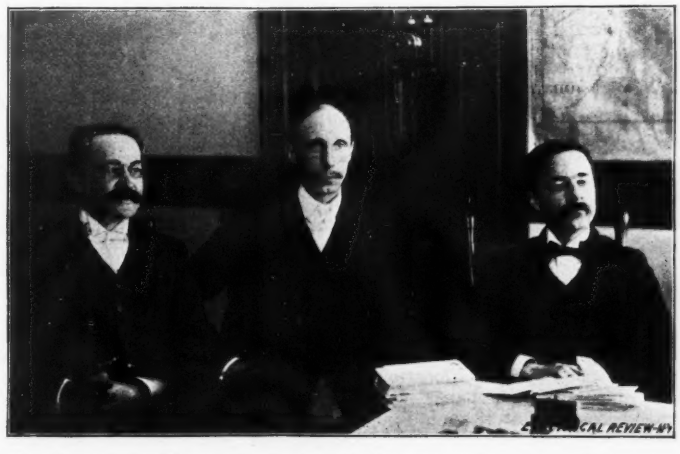
Such a root-word is "autema." The literal meaning is, of course, "self-goer" or "self-mover." The driver of such a vehicle would be an "autemist." The practice of the art or sport of driving autemas would be known as "autemy."

This word lends itself equally readily to the formation of the necessary combinations, all of them derived from the same language, and each sufficiently self-explanatory.

Thus, the steam-driven carriage is a "hydrema;" that in which oil of one kind or another is employed to furnish the motive power would be a "eulema," or, by prescription, an "olema." The electrically propelled vehicle is an "electrema," or possibly, in view of the now general use of the prefix "tel" in connection with the employment of electrical energy transmitted for a distance, and the popular association of this syllable with the idea of employing this form of energy, it might become allowable to accept such a word as "telema." For vehicles driven by compressed air, it would be difficult to find a term other than "pneumatema" in accordance with the system proposed, but this, if rather more cumbrous than the others, is not much so; it shares all their advantages in other respects, and it is, any way, far ahead of any equally descriptive term at present in use.

The principle is capable of all the extension needed in any direction. It is simple in origin, easy to use and easy to understand, and sufficiently elastic to permit of its being adapted to all and any of the developments which this method of locomotion may surprise us with in the future.

I must apologize for the length of this letter; but, personally, while no bigoted purist, I deplore the "higgledy-piggledy" nomenclature of mongrel origin, hideous form and limited scope which threatens to usurp the opportunity presented for instituting a system of terminology which should, and might, be at once simple, compact, expressive and self-explanatory. I remain, Faithfully yours,
CHARLES EDWARD SHELLY, M. A., M. D.
Hertford, Herts, Eng., May 16.



THE COMMITTEE WHICH DECIDED THAT "ELECTROMOBILE" IS THE PROPER NAME FOR AN ELECTRICALLY PROPELLED, SELF-CONTAINED VEHICLE FOR ROADS AND STREETS—BEGINNING AT THE LEFT THE GENTLEMEN ARE DR. LOUIS DUNCAN, MR. CHARLES BLIZARD AND MR. J. J. CARTY.

About 400 names were received in all. They came from England, South America and all parts of North America. One little town in Massachusetts contributed about 20. Naturally, in so many names, there were many duplicates, the prize-winning name itself having been sent in by two gentlemen. Many ladies submitted names.

Here are a few of the names sent in and considered:

Accelawait,	Autovolt,
Equine-nit,	Elecar,
Bacrotom,	Pacolet,
Automo,	Franklin,
Aut,	Automote,
Faraday,	Chevaless,
Autopropelectric,	Moby,
Electragon,	Plantemobile,
Trolley-Ho,	Electrola,
Moto,	Antiborse,
Locomobile,	Voltcar,
Telecar,	Quatrecycle,
Electropel,	Odomotor,
Autogo,	Autema.

In this issue of the ELECTRICAL REVIEW a number of interesting papers read at the recent convention of the National Electric Light Association are presented. The discussion of Mr. Atkinson's paper, brings out two matters of great importance—the relations of central stations to electromobiles and the value of the new system of series alternating arc lighting—will be given in next week's number.

A LOCAL TRANSMISSION SYSTEM—DEVELOPMENT AND OPERATION.

BY W. S. BARSTOW.*

(Concluded from page 350.)

In considering the question of an underground system for high-tension work, three important points arise: first, the style of conduit; second, the style of the insulation of the cable; and, third, the mechanical protection of the cable.

The style of conduit used in Brooklyn may be termed a closed system, owing to the fact that it has been the endeavor to keep the entire conduit system as water-tight and dry as possible. A vitrified tile duct is used, with water-tight joints, and the brick manholes are of double construction, filled in with tar, and built on heavy concrete foundations resting upon creosoted timbers. The covers of the manholes are patterned after the Edison ten-stub junction-box top. The inside cover is provided with a rubber gasket, and held in place by bolts. The outside is simply a heavy cover, acting as a mechanical protection to the inside one. The conduit system is connected to the unused brick stacks of the stations in which steam has been removed and transforming apparatus substituted. In addition, a blower is operated at the Bay Ridge station. The movement of air through such a large system, composed of some 100 miles of duct, is very slow, and yet it is sufficient to keep the system in good condition.

The reason for the adoption of a tile conduit as moisture proof as possible was in the main on account of electrolysis. In making preliminary tests along the proposed line of conduit it was found that the pressure from metallic substances to ground varied from 10 volts negative to 26 volts positive Thus it would only be a question of time before the heaviest lead cover would be totally destroyed. It was also found that the only solution was to make the lead cover of the cable negative to ground throughout the entire system. This demanded that all stray currents should always flow to the lead cover and should never leave it. Such a condition required that the lead covering of all the cables should be connected to the negative bus-bars of the railroad power-houses by insulated conductors of low resistance.

The materials for insulation of conductors seem to have narrowed down to two in number, paper and rubber, and in conjunction with these might be considered the arrangement of conductors themselves. Three methods of arranging the conductors for three-phase work are in use up to the present time: First, concentric cables; second, three conductor twisted or "clover-leaf" cable; third, three distinct and separate conductors. Each of the above arrangements has its own particular value, depending on local conditions and requirements. All concentric cables should have the outside conductor grounded, to protect them from the increased pressure due to their arrangement. It is a very difficult form of conductor to handle, and is not of any particular advantage, except in very high frequencies. The three-conductor twisted or "clover-leaf" cable is the arrangement generally provided for in all large installations, as on a frequency of 60 cycles, or under, the inductive effect is very small, and the arrangement of conductors gives a strength that is very necessary for the life of the cable. Separate conductors, separately insulated and drawn into different or the same ducts, can be used with a frequency of about 25 cycles without any noticeable effects from induction, and in many cases this arrangement is much preferred, as defects are easily repaired, and one extra conductor gives the advantage of a duplicate feeder as far as accidents are concerned.

Paper insulation, when made up with a liquid compound and of sufficient thickness, and when carefully laid, possesses some advantages, especially when such a cable can be laid for all time and need not be withdrawn and laid in other locations. Almost all defects in paper cable develop at bends; but if such bends are carefully made, and the cable carefully handled in the laying, it is as satisfactory and lasting as any insulation in the market, as it is composed of material that is naturally homogeneous in its "make-up." Rubber insulation, unless properly specified, is somewhat uncertain, as the term "rubber" has come to include a variety of compounds which, although insulators momentarily, become fair conductors after short use. In almost all cases of large installations engineers prefer to specify, besides the quality of insulation, the thickness of the same, as this thickness has much to do with the life of the cable. Up to within a short time ago it was sufficient to test cables with 50 per cent higher voltage than that which they were expected to carry, the test being made by placing the cable in a tub of water. In multiphase work, and especially in large installations, many phenomena occur which require that the specifications should be more rigid. Resonance and induction, under certain conditions, produce effects that, for an instant, more than double the pressure on the system, such high pressure occurring at different points or nodes, and in no way affecting the ordinary operation of the system. This was ascertained in Brooklyn by the placing of spark gaps set for 12,000 volts at predetermined points on the system. In the event of sudden grounding of an outside conductor on overhead line, the current invariably jumped the spark gaps at these points, although no effect was noticeable on the working system, the pressure at the generating and substations remaining steadily at 6,000 volts. There also exists the possibility of some careless attendant in some unusual excitement throwing in multiple two generators which are not in exact phase, this resulting in a sudden increased pressure. The adjustment of the power factor in a distant substation will even cause these waves to appear and pressure to be built up at certain points without seriously affecting the instruments at the stations. In order, therefore, to provide for all such emergencies, no cable should be purchased or installed unless it will stand for one hour at least double the working pressure, this being equivalent to a puncture test of more than three times the working pressure.

A cable as ordinarily made up provides for half the insulation between ground and conductor as between conductors themselves. This, under perfect conditions of operation, should be sufficient, but when practical experience is referred to it is often found, where overhead conductors are employed, that one conductor of the system may become temporarily and accidentally grounded, in which case the same pressure with half the insulation, exists between ground and conductor as between the conductors themselves. In order to more evenly distribute the strain of the cable, "split" insulation has often been used. This arrangement provides for an insulation around each conductor itself, and an insulation around all three conductors when made up and before the lead covering is put on, thus making the insulation between the lead covering and any one conductor the same as that between any two conductors. The thickness of the insulation itself will depend entirely upon the lasting quality of the insulator rather than on the ohmic resistance of such insulator. In other words, an insulator with low ohmic resistance may be preferable to an insulator with high ohmic resistance, if its quality is more lasting. Cables with very high insulation have been known to break down suddenly, while cables with a low insulation have been known to last indefinitely.

The question of mechanical covering for the cable itself depends upon the nature of insulation, the liability to electrolytic action, or the effect of gases. Paper cables must necessarily be covered by lead or other moisture-proof material, the life of the cable depending upon such moisture-proof covering. Rubber cables, when subject to electrolysis, can be protected by a covering of waterproof asbestos, surrounded by a very heavy braided covering, put tight and thoroughly saturated with compound. In Brooklyn all cables, whether rubber or paper insulation, are covered, wherever they pass through manholes, with heavy asbestos tape. In case a burnout occurs on a cable, with 1,000 or 2,000 kilowatts behind it, such an arc and heat is developed that injury is apt to result to adjacent cables, and it was found that by protecting each cable in this way further damage has been prevented.

The design and equipment of a substation in a multiphase system depends almost entirely upon local conditions, as the substation contains merely whatever transforming apparatus is necessary to reproduce the energy in the form desired for distribution suited to the local conditions. These transforming devices are commonly as follows:

1. Static converters and rotary transformers for transformation of multiphase into low-tension direct current.

2. Synchronous or induction motors directly connected to arc machines or constant-current transformers, with rectifying commutator for converting multiphase energy into continuous series arc current.

3. Frequency, phase and voltage-changer, when it is desired to change the frequency, phase and voltage, and the transmission current for distribution.

4. Constant-current transformers, when it is desired to regulate the multiphase transmission current for use in series alternating arc service.

As the efficiencies of these different transformer devices would, no doubt, prove interesting, the following data have been collected from the daily records of the Brooklyn system:

1. Three 150-kilowatt static converters and two 200 kilowatt rotary transformers, when taken together at three-quarter load, measuring (by wattmeters) the high-tension multiphase energy entering the static converter, and the direct-current, low-tension energy (by wattmeters) leaving the rotary transformer, show an "every-day" efficiency of 84 per cent.

2. The following is the measured efficiency of an entire substation composed of synchronous motors driving arc machines to a capacity of about 1,200 high-tension series arcs:

Total multiphase energy entering the station (by wattmeters) during night run.....	5,779 K.-W.-H.
Series arc energy leaving the station during night run.....	4,290 "
Commercial efficiency of substation.....	74.3 per cent.
Power-factor.....	98.2 "

With all machines fully loaded, an efficiency of 76 per cent is reached.

3. The frequency, phase and voltage-changer, measuring the multiphase energy input and multiphase energy output, at three-quarter load, shows an efficiency of 86 per cent.

4. The constant-current transformer at full load possesses an efficiency a little under that of the regular static type. At half load the efficiency becomes quite low. Owing, however, to the fact that in installations of any size it is always possible to secure about three-quarter load,

* Read before the National Electric Light Association, New York, N. Y., May 23, 1899

the efficiency in actual practice is about 88 per cent.

The average line loss in Brooklyn from the power station to the substations amounts to two per cent, and taking the total energy generated and distributed from the bus-bars in the Union station or generator station and that delivered by the bus-bars in the substations to the distributing system, the loss is 20 per cent, showing an efficiency of the entire system, including loss in transmission and conversion under the different forms of current, of 80 per cent. This does not include the loss on the distributing system from the substation to the customers. These are ordinary operating figures, and are somewhat higher than would be naturally expected, the good results being no doubt due to the high efficiency of the large static transformers (97 per cent) at full load as well as that of the large synchronous motors, and the fact that the operation is so arranged that no transforming apparatus runs at less than three-quarter load and averages nearer full load.

The local multiphase transmission system is, in itself, a promoter of consolidations, as well as an economist in energy production. Besides making itself felt in the "everyday" commercial world, it is forcing upon the manufacturing industries new developments in steam and electrical machinery. At the time of the completion of the Brooklyn system, some 18 months ago, a single unit, generating steadily 2,000 kilowatts during each hour of the day, was somewhat of a novelty, but now in the same plant will shortly be operated two units of 5,000 horse-power each. Yet, it is not the mere increase of the size of the unit that demands careful forethought on the part of the designer and manufacturer, but rather the handling with safety of such units, as new problems of detail, construction and operation are brought forth under these new conditions. With the public growing more and more critical day by day, the old central-station idea of "what to do in case of an accident" gradually gives way to that of "what to do beforehand to prevent the occurrence of the accident," and yet, with the constant advance in design and manufacture of modern machinery, there should be no reason why, as the size of the unit increases, the tendency of accidents should not rather decrease. The electrical world can well remember when a 500-horse-power unit was classed a large venture, but it now already seems as if a 10,000-horse-power unit would soon be well under way. The limit of such development seems to be almost entirely in the hands of the engineer and manufacturer, no limits having yet appeared from the business operating standpoint. Possibly the near future will see the engine and generator done away with, and what will then be the limits of efficiency and magnitude in electrical generation and distribution can, at this time, hardly be foreseen.

A New Line of Electric Motors.

In the illustrations herewith are shown two examples of a new line of electric motors recently placed on the market by the Jenney Electric Manufacturing Company, of Indianapolis, Ind. These motors have been named "Universal" on account of their construction.

Fig. 2 illustrates the motor mounted in the usual manner, with the supporting base on the under side, and with a standard pulley on the armature shaft. Fig. 1 illustrates the motor bolted to the side of a post, and with back gear

The frame of the motor is spherical, and provided with two circular bands

FIG. 1.—GEARED MOTOR WITH BASE IN VERTICAL POSITION.

which are turned true to gauge, and drilled uniformly all around the bands to enable the supporting foot to be attached at various angles, so that the motor can be attached to a ceiling or side wall, either right or left handed, and at various other angles. The supporting foot can be made in any special shape desired to enable the motor to be coupled to special machinery. The bearings for the back gear are also drilled so that they can be attached to the body of the motor frame at any position desired.

The makers claim the great advantage in this arrangement is that a very slow speed can be obtained from the back gear shaft with a comparatively small motor, which results in the cost of the outfit being much less than is the case where a large motor frame is wound to obtain slow speed, and the efficiency of the motor is also claimed to be very much higher.

The back gear enables slow speed to be obtained directly from the motor, without the necessity of a countershaft and extra belt.

Where the motor is to be installed in dirty places and exposed to flying particles the heads are entirely housed.

These motors are multipolar, having four poles, and are constructed with wrought-iron field cores and the slotted-core type of armature. The armature windings are form-wound and insulated before being placed on the armature. The parts of this machine are interchangeable and the bearings self-oiling.

These machines are now made in sizes from one half to five horse-power inclusive, for both moderate and slow speeds and for all standard voltages, and the company reports that it will soon be in shape to furnish this same type of machine in larger sizes.

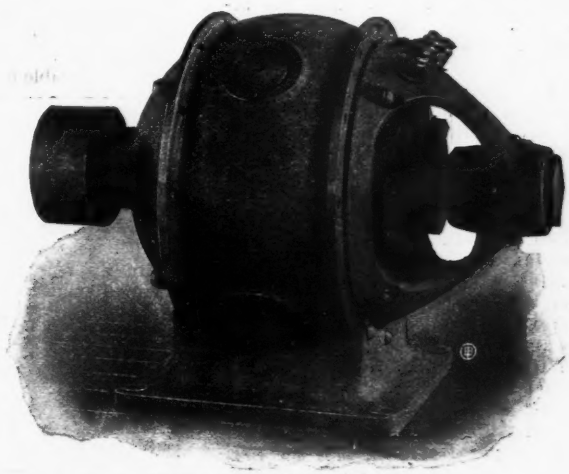


FIG. 2.—BELTED MOTOR UPRIGHT ON BASE.

General Meeting of the American Institute of Electrical Engineers.

The sixteenth general meeting of the institute will be held at the Massachusetts Institute of Technology, Boston, on June 26, 27 and 28. The meeting of 1890 was held at the same place and was quite largely attended, considering the membership at that time, which was only 540 or less than half the present number. The following papers are scheduled for presentation:

"Polyphase Electric Testing Methods," by Prof. H. J. Ryan.

"Symbolic Representation of General Alternating Waves, and of Double-Frequency Vector Products," by Chas. P. Steinmetz.

"Note on the Progress of the Closed Globe Arc Lamp," by Louis B Marks.

"The Cost of Operation of Some Building Plants in New York City," by Percival R Moses.

"Constant-Current Transformers," by Prof. W. L. Robb.

"Notes on Recent Developments in Single-Phase Induction Motors," by Chas. P. Steinmetz.

"Elements of Design Favorable to Speed Regulation in Plants Driven by Water-Power," by A. V. Garratt.

"Protection of Alternating Secondary Circuits," Dr. Cary T. Hutchinson.

"Air Gap and Core Distribution" (Part Second), by Prof. W. E. Goldsborough.

"Electricity in Coal Mining," by Prof. J. P. Jackson.

Other papers suggested, but definitely settled upon, may possibly be presented by A. D. Adams, S. E. Deane, E. A. Sperry and Professor Laws.

Among the objects of engineering interest, which are likely to be visited, are the Cambridge pumping station, the South Boston electric light station, the electric plant of the Union Railway station, the Atlantic avenue Edison station, the central power station of the Boston Elevated Railroad, the West End power station at Cambridge, and the new Boston fire-alarm station.

Wisconsin Telephone Company.

A special meeting of the stockholders of the Wisconsin Telephone Company has been called, to be held in Milwaukee on June 19, for the purpose of increasing the capital stock of the company from $1,200,000 to $3,000,000. The proceeds of the new stock sale will be used in covering the state with a network of long-distance lines; the erection of eight or ten exchange buildings, and in increasing the number of subscribers by at least 15,000 in the state. When this extensive work is completed the Wisconsin company will have at least 25,000 subscribers and one of the finest telephone systems in the world.

Means of Attaining Safety in Electrical Distribution.

(Concluded from page 355.)

these surfaces are lined with muslin that has been treated with shellac or varnish and pressed into the desired shape. This lining covers the interior of the chamber in which the fuse is broken and the porcelain surfaces between which the fuse is drawn. These linings are supplied with the new fuses and are renewed if any appreciable amount of burning has occurred.

With a fuse of this type, occupying a space of six inches by three inches on a switchboard, I have repeatedly broken 300 amperes at 13,000 volts without the slightest injury to the device.

Fig. 8 illustrates the principle of a circuit-breaker that has produced excellent results. Two terminals are placed side by side on a vertical board, and are separated, both in front and behind the board, by high barriers. Into the metal surrounding these terminals stout fiber tubes are attached, which extend downward on either side of the barrier. Two copper rods, connected at the bottom by a crosshead, are inserted in these tubes, and forced upward until they make contact in the terminals; the circuit is thus established through the copper rods and the crosshead around the lower extremity of the barrier, and through the fiber tubes. The crosshead carries a piston, and this piston moves in a long, air dash-pot. To set the circuit-breaker, the rods are forced upward, by means of a wooden rammer, until the contacts are made; in this position the rods are held by a latch controlled by a solenoid. When the proper amount of current is put through this solenoid the latch is released; a spring starts the rods downward, so that the circuit is broken in both tubes, the gas produced by the arc expels the rods rapidly from the tubes, the acceleration being checked by the dash-pot. This device has been found very effective on the heavy circuits with which we have experimented. It occupies a small amount of space, and is simple in its mechanical construction.

Fig. 9 illustrates the construction of a switch or circuit-breaker somewhat similar in principle to that shown in Fig. 8. In this case the terminals are at the lower end and are situated inside of vessels into which the fiber tubes project for a short distance. These vessels are partly filled with oil, the break occurring below its surface. In the switches of this type which we have designed the rods have been withdrawn from the tubes by a pneumatic cylinder. The presence of the oil materially increases the breaking power of the switch and reduces the violence of the explosive effect when the circuit is opened.

Fig. 10 shows a shunt fuse device that has been used in connection with circuit-breakers at Niagara Falls and elsewhere. The object of the design is to produce a fuse that can be placed in shunt with the circuit-breaker, to open the circuit after the main contacts are broken. It is, of course, desirable so to design such fuses that they can be very easily replaced. The fuse is placed in a slot in a long wooden rod; this wooden rod is covered by a paper tube, and part of the wood is cut away at three points, so as to form air chambers inside of the paper tube. The rod is inserted in a long wooden tube, provided with vents that come opposite to these air chambers when the fuse is in place.

THE NEW YORK ELECTRICAL EXHIBITION—THE AMERICAN ENGINE COMPANY'S EXHIBIT.

Another form of fuse, which has been found very effective for difficult conditions, consists simply of a short piece of glass or porcelain tube with terminal at each end, and an asbestos lining to prevent burning of the porcelain. The objection to this type is that the gas is blown with great violence from both ends of the tube, and must be diverted from surrounding conductors, or else short-circuits are liable to be caused by it.

THE NEW YORK ELECTRICAL EXHIBITION—EXHIBIT OF THE J. JONES & SON COMPANY AND THE H. W. JOHNS MANUFACTURING COMPANY.

The fuse is a small copper wire, and is attached to ferrules on the rod which make contact with springs at both ends of the tube. When the current is diverted into the fuse, which immediately volatilizes, the pressure in the chambers bursts the paper opposite the vents and the gas escapes through chimneys provided above the vents. The paper covering of the rod prevents the hot gas from getting into the interior of the tube; consequently the device can be used over and over again without any deterioration. These fuses have worked perfectly in parallel with circuit-breakers, under the most difficult conditions that we have yet been able to produce.

Many forms of fuses have been designed that operate inside of tubes with closed ends. Some of these fuses act very well with limited amounts of power. If, however, the capacity of the circuit is sufficiently large, the tube will be exploded with great violence. My experience is that the open-ended tube never explodes and never fails to open the circuit. It is, however, only practicable in certain cases, because of the heavy discharge of gas from its ends, on account of which it has to be given a good deal of room.

Missouri & Kansas Dividend.

The Missouri & Kansas Telephone Company, on May 15, sent out a quarterly dividend of one and one-fourth per cent to its stockholders. This company, whose main office is at Kansas City, Mo., is a conservatively and ably managed one. Its officers are J. R. Mulvane, president; Alonzo Burt, general manager; N. R. Ferguson, secretary, and H. W. Bellard, treasurer.

Aluminum vs. Copper.

In a copper circular issued by Aron Hirsch & Son, metal dealers, of Halberstadt, Germany, the firm writes of the American aluminum industry as follows: "In America, on account of the progressive business and the scarcity of copper, aluminum has been used as a substitute in large quantities. At a price of 200 marks per kilogramme it is, on account of its light weight, really cheaper than copper. The American aluminum production for the year 1898 was 2,600 tons. The output of the works at Niagara Falls for 1899 will be increased to 5,000 tons. The American output is already greater than the entire output of Europe, 650 tons having already been used in 1898 for conductive purposes. We mention this here because, even if this production is at present small, this metal is becoming more and more important, and this information may be desirable to many. We will be glad to furnish further information on application."

It is pointed out that, with the annually increasing consumption of copper, the civilized world in 1908 will need a supply of 900,000 tons, and it is stated that to get this a great deal of prospecting and mining will have to be carried on in the next 10 years. There is a possibility, however, that by 1908 aluminum will have replaced copper to such an extent that it will considerably reduce the world's consumption of the red metal. As prices for copper remain high, the demand for aluminum for electrical conductors continues to be heavy, and the works of the manufacturers are taxed to the utmost to supply enough wire.

Electrical Exhibition Notes.

The electric automobile to be presented to the most popular actress, as determined by ballots cast by visitors to the show, was won by Miss Maude Adams, Miss Lillian Russell having the next largest number of votes.

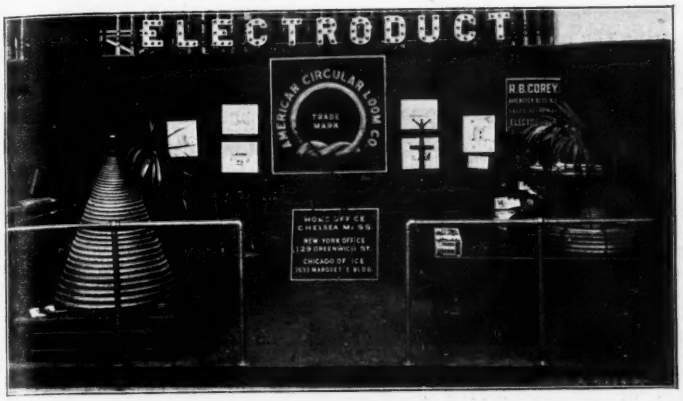
The Burnet Company, 115 Maiden lane, New York, exhibited an attractive array of incandescent lamps, both of the ordinary and tipless patterns. These lamps are manufactured in several styles and many different colors.

Mr. Marcus Nathan received from a number of the exhibitors a large and handsome solid silver loving-cup, as an evidence of their appreciation of his efforts in their behalf while general manager of the show. Mr. Nathan expressed his thanks appropriately—with the aid of the cup.

Two of the engravings herewith presented show the exhibits of the John A Roebling's Sons Company and the Safety Insulated Wire and Cable Company, two of the handsomest displays made by exhibitors. These were described at length in a recent issue of the ELECTRICAL REVIEW.

The illustration opposite represents the American Engine Company's exhibit of its new type of compound engine, direct-connected to an American Ball six-pole generator. This outfit was very fully described in the ELECTRICAL REVIEW of May 24. It has attracted more than passing attention from members of the Electric Light Association and others who have visited the exhibition.

The J. Jones & Son Company, New York, made a particularly fine exhibit of battery-fan outfits and wall switches. A special feature of the exhibit was the Noark fuse, manufactured by the H. W. Johns Manufacturing Company. This fuse was exhibited in operation, and its working contrasted with that of the ordinary open-air fuse by its inventor, Mr. Joseph Sachs. In the center of the booth stood a handsome switchboard showing the Jones time cutout. The exhibit was in charge of Mr. H. J. Stevens.



THE NEW YORK ELECTRICAL EXHIBITION—THE AMERICAN CIRCULAR LOOM COMPANY'S EXHIBIT.

THE NEW YORK ELECTRICAL EXHIBITION—THE JOHN A. ROEBLING'S SONS COMPANY'S DISPLAY.

The exhibit of the American Circular Loom Company, of Chelsea, Mass, is well shown in the illustration. Electroduct, or seamless flexible interior conduit, is exhibited in the shape of a pyramid. This is composed of various sizes of electroduct. At the back of the booth the company's trade-mark is shown in a curious perforated electric sign which has attracted much attention. The exhibit was in charge of Mr. H. B. Kirkland.

The Jenney Construction Company has been organized, with offices at 26 Cortlandt street, New York, for the purpose of installing Montauk automatic fire-detecting cable. The officers of the company are I. H. Jenney, president; E. A. Brinkerhoff, Jr., vice-president; L. W. Jenney, secretary and treasurer. This company is in a position to furnish estimates and all particulars relative to the installation of this fire-detecting cable for the protection of hotels, churches, theaters, etc, and will be glad to offer practical demonstrations of its splendid success in the past.

Annual Meeting of the New York Electrical Society.

The annual meeting of the New York Electrical Society for the election of officers took place at the electrical exhibition, Madison Square Garden, on the evening of June 3. The following members were elected: Frank Gordon Rice, Chas. B. McLeer, J. C. Forsyth, Edward A. Mahar, Jr., Ernest R. Bartlett, Chas. M. Crowfoot, A. M. Young, J. Arthur Holly, Joseph M. Cooper, and Henri W. B. Blomquist.

The report of the secretary showed that 135 members were elected during the past year, and the total number of members now on the books of the society is 704. The average standard of the meetings has been appreciably raised, and the average attendance throughout the year has exceeded 200, thus breaking all the records of the society. The secretary does not recall any time when the society has stood so high in public estimation, has had a larger steady accession of membership, and could point to a better record in a year's work than now.

The report of the treasurer showed that the society is in better financial shape than it ever has been. A detailed statement of the receipts and disbursements for the past year will shortly be mailed to each member of the society.

The election of officers resulted as follows: President, Gano S. Dunn; vice-presidents, Dr. C. A. Doremus, Frank A. Pattison, Charles Blizard, Arthur Williams, F. V. Henshaw, Stephen L. Coles; secretary, George H. Guy; treasurer, Henry A. Sinclair.

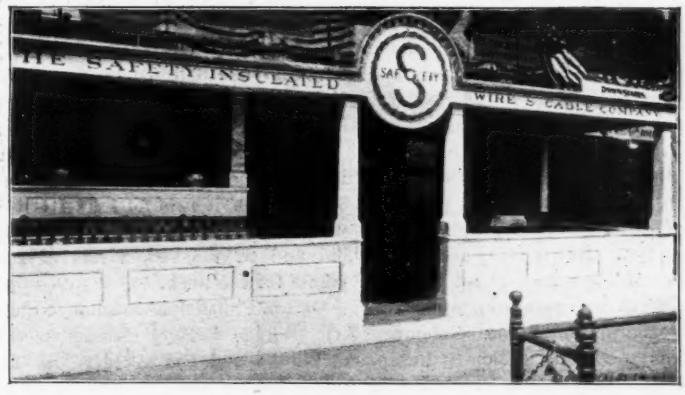
After the business meeting Mr. W. J. Clarke lectured to a crowded audience on "The Future Possibilities of Wireless Telegraphy."

PERSONAL.

Mr. John Stone Stone, formerly of the engineering staff of the American Bell Telephone Company, has opened an office in the Phillips Building, Boston, as electrical engineer and electrical expert. Mr. Stone possesses ability of a high order, and is sure to meet with abundant success in his new field.

Mr. W. H. Preece, the eminent exchief of the British Government telegraph system and president of the Institution of Civil Engineers, has been made a Knight Commander of the Bath, on the occasion of the Queen's eightieth birthday, and in deserved recognition of his important services.

Mr. M. M. Wood, formerly of the Ohio Brass Company, of Mansfield, Ohio, and Central Union Brass Company, of St. Louis, Mo., has recently taken the management of the street railway department of the Central Electric Company, of Chicago. Mr. Wood is well known to the electrical field, and as it is the intention of the Central Electric Company to vigorously push this department, his long experience and ability in this line will very materially increase the company's sales.



THE NEW YORK ELECTRICAL EXHIBITION—THE SAFETY INSULATED WIRE AND CABLE COMPANY'S EXHIBIT.

Nernst Lamps in Practical Service in Berlin.

The Nernst incandescent electric light is shortly to receive a practical trial at the hands of the Berlin municipal authorities, and it is proposed to use this light on some of the streets of the Thiergarten district. As the Nernst lamp is believed to be quite economical when of sufficient size, it is thought that this trial will go far towards demonstrating its utility for general illumination.

Renewal of Options for the Proposed Rubber-Covered Wire Combination.

The ELECTRICAL REVIEW is authoritatively informed that the options on the manufacturing plants for rubber covered wire, which it is proposed to bring within a combination, have been extended from June 1. As published in these columns recently, it was the original plan to consummate the negotiations before that date or let the matter drop, but owing to the death of one of the organizers the renewals have been made and the effort will be continued.

Electricity in Turkey.

Till recently the employment of electricity in any shape or form in Constantinople was strictly forbidden, says our London namesake. For an unfortunate official to mention the word "electricity" in the hearing of the Sultan was as much as his place, if not his head, was worth. Incredible as it may appear, his Serene Highness naively imagined that a dynamo must have something to do with the manufacture of dynamite. So much is there in a name. The final triumph over the prejudices of the Sultan is said to have been due to a Spaniard and the kinematograph. This Spaniard, Don Ramirez by name, started a circus in Constantinople, and in order to be up to date, imported a kinematograph. But the city authorities would not allow him to set his new instrument in operation, because it had to be driven by the condemned electricity. In his difficulty he applied to his ambassador, who promised to do his best for him. During the next audience which he had with the Sultan, the wily diplomatist took occasion to enlarge on the wonders of the kinematograph, and interested the Sultan so much, that Don Ramirez was ordered to bring his instrument to the Palace. Moving scenes from the leading capitals of Europe were thrown on the screen for the delectation of the Sultan, who no doubt enjoyed them all the more, since he is not, like his friend the German Kaiser, a great traveler. Among the indirect results of this exhibition was that the Sultan became convinced that electricity, though produced by a dynamo or a battery, had no connection with dangerous explosives; the lucky Don got kudos and wealth, and permission was granted to him to install in his circus the first electric lighting plant in Constantinople.

Wall Street and the Electrical Stock Market.

The state of affairs in Wall Street was considerably strengthened and improved by a sharp and general recovery in prices on Friday of this week. A renewal of the bull movement has been proclaimed, but whether Wall Street's hopes will be realized remains to be seen. The reaction in the industrial shares, which has taken place since April, has been of substantial proportions. The downward movement has been considered a good thing on the whole. The business failures in April were the smallest for a month on record. The activity in the iron and its allied industries continues to be a remarkable feature. The active state of trade is clearly reflected in the returns of railway traffic and in the bank clearances throughout the country.

On the New York Stock Exchange General Electric closed the week at 118 bid and 118½ asked, indicating no change for the week. Metropolitan Street Railway, of New York, closed at 214¼ bid and 214½ asked, a loss of 6½ points for the week. Third Avenue Railroad, of New York, closed at 190 bid and 192½ asked, a loss of 12½ points for the week.

On the Boston exchange American Bell Telephone closed at 335 bid and 340 asked, a loss of 3 points for the week. Erie Telephone closed at 92 bid and 92½ asked, a loss of 2½ points for the week.

On the Philadelphia exchange Electric Storage Battery common closed at 143 bid and 155 asked, a loss of 5 points for the week. Union Traction closed at 41⅛ bid and 41⅝ asked, a gain of ¼ point for the week.

On the curb or outside market in New York Electric Vehicle closed at 105 bid and 110 asked, a loss of 3 points for the week. Electric Boat closed at 17 bid and 20 asked, a loss of 25 points for the week.

Wall Street, June 3.

GENERAL TRADE NEWS.

The L. B. Allen Company, of Chicago, report a large and constantly increasing business. They are manufacturers of the Allen soldering compounds, Allen's soldering salts, and the Allen soldering stick.

During the past week the Western Telephone Construction Company has been busy placing a lot of new machinery in their factory, 250 South Clinton street, Chicago. The machinery added is practically a duplicate of the present machinery in use, giving them double the capacity in their machine shops of that heretofore. The company reports an extraordinary order business, and most flattering letters with reference to the recent improvements in telephone apparatus.

The Ferracute Machine Company, of Bridgeton, New Jersey, U. S. A., make a large line of presses and have recently issued a new catalogue 12, describing over 300 sizes and kinds of presses, etc., a number of which are especially adapted for electrical work. They make a specialty of outfits for manufacturers of electrical goods, and have recently designed a disk notcher for notching armature disks from three inches to 48 inches in diameter. They fit up their presses with motors when required, which reduces the cost of power arrangements considerably. They will be glad to send catalogues to electrical goods manufacturers.

The Western Electrical Supply Company, of St. Louis, Mo., are still keeping pace with the times with their usual spirit of push and energy, and are as usual always picking up good things and are among the first to offer them to the trade in general. Their numerous salesmen are at the present time constantly hustling for business in nearly every locality in the central, western and southern states, and from their genial attitude and general appearance of being thoroughly satisfied with themselves, and the world in general, they are evidently receiving fully their portion of the patronage, which can, however, be only a natural consequence considering the general high quality of goods that are handled by the house they represent.

Mr. J. J. Wood, of the Fort Wayne Electric Works, is quoted by a newspaper as saying: "We are running our factory full time and have been obliged to add several hundred men to our factory force within the past week or two. The arc lamp business was never better at this season of the year. We have been kept busy filling unsolicited orders from customers who absolutely decline to consider any apparatus other than that for which Fort Wayne has become famous. Only yesterday we received an order for 400 arc lamps from Chicago, and our designers are at work on a special lamp for another large order, which we are practically certain of. The instrument business has practically never been interrupted. We are still making the Fort Wayne Duncan wattmeters, and our orders are so numerous we are experiencing some difficulty in securing raw material. In fact, I find this is a common complaint among other manufacturers at present, and it is certainly a positive indication of great revival in business."

The Montauk Automatic Thermostatic Fire Detective Cable covers a field which heretofore, electrically speaking, has but tentatively been occupied. Messrs. Stanley & Patterson, of New York, a firm well known to the electrical trade, and jobbers in this cable, among other installations, have recently placed an equipment in the home of Mr. Joseph Pulitzer, of the New York *World;* the firm of Boscher & Hartwell, electrical contractors, among other installations, have recently equipped the Winter residence of Mr. George Taylor, in New York city, and also his Summer residence on Long Island; the Jenny Construction Company, Havemeyer Building, are doing a prosperous business in the installation of this cable, and among the many installations made by them may be mentioned the Winter and Summer residences of Mr. A. A. Cowles, president of the Ansonia Brass and Copper Company. Among the various installations made by the Gamewell Auxiliary Fire Alarm Company, the Dundee Chemical Works, Passaic, N. J., and the Jessup & Moore Paper Mills, Wilmington, Del., may be cited.

The Central Electric Company, Chicago, have taken the selling agency for the efficient and well known Philadelphia arc light cutouts. These cutouts have had the test of seven years' service, with such improvements from time to time as would meet changing conditions, with the result that the best of all recommendations are shown by the absence of all complaints. While the articles are intended for use on high-potential arc circuits up to 50 series arc lamps, yet they are most useful to break current on any system. The Philadelphia arc cutouts are housed in durable iron boxes, with the wire entrances and exits provided with porcelain bushings. The interior is of glazed porcelain base, the nature of which prevents any absorption of moisture. The metal parts are of ample size, with two phosphor-bronze brushes on each brush post. In the "lever" and "pull" types, these two brushes provide a double contact on the center disk—a strong safety factor—for by this means a large breaking space is offered. A "plug" type is made to supply testing requirements and also where a total disconnection of line or lead-in wires are required. The prices on these several forms are not high and full information is supplied by the Central Electric Company upon request.

Some Interesting Telephone History.

Twenty-two years ago this Summer Mr. Chas. J. Glidden, now president of the Erie system of telephone companies, commenced the canvassing of Lowell for subscribers to one of the first telephone exchanges in the world, says the Lowell, Mass., *Mail*.

Mr. Wesley R. Bachelder (Whithed & Co.) was the first subscriber and Alderman Edward B. Peirce, second. The Lowell District Telephone Company started with 45 subscribers, costing $6,000. The system was constructed on house-tops by Mr. Glidden, and Mr. J. Clark Glidden became the first operator. This $6,000 capital and 45 subscribers was the foundation of the New England Telephone Company, now operating 60,000 subscribers, employing $18,000,000 capital. The little Spindle City Telephone Company also inspired the great Erie telephone system now operating in eight states 80,000 telephone subscribers, and employing $25,000,000 of capital and 5,000 people. The amount of capital used in the Erie system combined is 10 times greater than that of our largest manufacturing company, the Merrimack, and eight times greater than the largest manufacturing company in the United States, the Amoskeag, of Manchester, N. H. Lowell therefore is not only one of the greatest cotton cities of the world, but may properly be designated as the father of the telephone exchange and long-distance system of the world, the first long distance service being given between Lowell and Boston. The New England and Erie companies combined operate 140,000 subscribers and employ $43,000,000 capital.

The directors meet weekly and authorize after the examination of approved estimates prepared by the various local managers and officers, the construction and reconstruction work throughout the entire territory. At a recent meeting the work approved for the Michigan territory compiled after personal inspection by officers of the company amounted to over $1,500,000.

The executive officers of the company are: Chas. J. Glidden, president; Chas. A. Grant, treasurer, and Geo. B. Perham, secretary; John C. Burke, Esq., general counsel for the executive department, and Hon. D. F. Morgan, of Minnesota, general counsel for the operating department. Mr. H. J. Pettengill represents the executive department as vice-president in the field, so to speak, and Mr. James P. McKinstry as vice-president, is head of the operating department. Most of the directors living in New England have been long in the telephone service, Mr. Glidden, 22 years; Mr. Wesley A. Cove, vice-president of the First Ward National Bank of Boston, Mr. Asa C. Russell and Mr. James W. C. Pickering have been members of the Erie board 15 years; Mr. Levi Sprague, 12 years; Mr. Harvey A. Whiting, of Wilton, 11 years; Mr. Chas. S. Tuckerman, vice president and treasurer Old Colony Trust Company, Boston, four years; Mr. David S. Greenough, of Boston, two years; Messrs. John C. Burke and James H. Mills, of this city, are new members of the directory, having been elected about a year ago.

Gen. Thos. Sherwin represents the Bell interests, and has been a member of the subcompanies' board of managers 12 years, and meets regularly with the Erie members. This is not a rash prediction to make; namely, that before the end of the next 20 years the two great telephone companies born in Lowell, the New England and Erie, will be operating 500,000 subscribers, an enormous long-distance service, and employ $100,000,000 of capital.

Copper Deposits of Bolivia.

According to the *Society of Arts Journal*, the Bolivian copper formations extend in an almost uninterrupted line from south to north, following the general direction of the eastern chain of the Andes. The only beds worked to-day are those of Corocoro, upon the high plateau of Titicaca. The distinctive feature of these beds is the abundance of native copper, in forms varying from microscopic grains to great masses weighing several tons; in wealth they rank second only to those of Lake Superior. The most primitive and imperfect methods of working these beds are employed. The scarcity of fuel does not permit fusion on a large scale of the various combinations of the metal. As a matter of fact there are only two furnaces at Corocoro. The ore is broken with hammers by women, passed through mills worked by hand or by hydraulic power, undergoes two washings in inclined trenches, and finally is dried either by the sun or by artificial heat. The ore produced is of a standard of not less than 70 per cent. The quantity extracted in 1897, as given by the four companies of Corocoro, was 2,912,566 kilogrammes (6,421,000 pounds). The Bolivian Government taxes every Spanish quintal (101 pounds) of ore about nine cents. The net cost of Spanish quintal of copper at Corocoro is about 24 cents.

A New Ceiling and Wall Switch.

Several contrivances have been devised for the purpose of controlling incandescent lights that are too high or otherwise inconvenient to reach. Many of these devices have been faulty in design and flimsy in construction, and have required two or more pulleys and cords to run over them. The result frequently has been that the cords are generally off the pulley and the two so entwined or tangled that it requires a period of experimenting before one discovers whether one is trying to turn the light on or off.

The illustration herewith shows a device for this purpose, which it is claimed

A New Ceiling and Wall Switch.

successfully eliminates all trouble of this character. The device consists of a double-pole knife switch, operated by a cam movement, which does the work of opening and closing. The pull on the chain for either movement is always down—one pull turning the lights on, the next pull turning them off. The operation of the switch is extremely quick, in either event, allowing no chance for drawing an arc. The operating mechanism is very simple, and no part of it is used as a conductor. These switches are mounted on slate bases, and are approved by the National Board of Fire Underwriters. They can be placed either on side walls or ceilings, and should be found a great convenience in show-windows and other situations where lights are inaccessible. The J. Jones & Son Company, 64 Cortlandt street, New York, are the manufacturers of these devices, and report that they are giving general satisfaction wherever used.

The Southwestern Gas, Electric and Street Railway Association.

The first annual convention of the Southwestern Gas, Electric and Street Railway Association occurred at Austin, Tex., May 17, 18 and 19. There were present over 100 delegates from Texas, Mexico, New Mexico, Arkansas and Louisiana. President Drake opened the convention, and Mayor McCall delivered a formal address of welcome. Mr. T. D. Miller, of Dallas, Tex., replied to the Mayor. The rest of the day was spent in a visit to Governor Sayers, and the State Legislature at the capitol and a ride to points of interest about the city. Mr. and Mrs. Drake entertained the delegates at a reception at their home in the evening.

The second day's meeting was devoted to the reading of officers' reports, including that of the president, who referred to the causes underlying the inception of the association. Mr. T. D. Miller, of Dallas, read a paper on "The Science and Art of Selling Gas." The afternoon was spent at Lake McDonald, and a reception and musicale were given in the evening at the Hotel Driskill.

Committee reports were heard at the third day's session, and the following officers were elected for the ensuing year: President, T. D. Miller, of Dallas; first vice president, J. F. Strickland, of Waxahachie, Tex.; second vice-president, C. A. Yeager, of Laredo, Tex.; third vice-president, W. E. Hamilton, of Shreveport, La.; secretary, T. H. Stuart, of Waco; treasurer, Fred Freis, of San Antonio, Tex.; board of directors, C. F. Drake, F. E. Scovill, of Austin; E. Dysterud, of Monterey, Mex.; Fred Freis, of San Antonio, Tex.; E. L. Wells, of Marshall, Tex.; J. C. Cullinane, of Denison, Tex.

The next annual convention will be held at Waco, Tex. Among the papers read and briefly discussed were the following: "A Model Plant Under Management," by J. F. Strickland; "Attractions for Street Railways," by T. H. Stuart; "Transformers," by Harry L. Monroe; "Means of Encouraging Diversified Use of Electric Current," by C. L. Wakefield.

A Mexican supper was served to the visitors at Hyde Park on the evening of May 19. The association sent to President Porfirio Diaz, of Mexico, a handsome silver plate, appropriately engraved, as a testimonial of their esteem.

SINGLE-PHASE DISTRIBUTION.*

BY HERBERT A. WAGNER.

(Concluded from page 343.)

Probably the best example of pure, single-phase distribution on a large scale is furnished by the Missouri Edison Electric Company, of St. Louis, and I can best show its possibilities by describing the results obtained by this company.

In a large portion of the city the usual system of individual transformers for every customer or adjacent customers is used. The current for these transformers is supplied by overhead feeders and distributed over high-tension overhead mains. In some districts one transformer is used to supply current for an entire block, by means of three-wire, low-tension secondary mains.

The principal business portion of the city is now supplied by underground conductors, covering a district of 40 miles of streets. A low-tension, Edison three-wire network of mains is used throughout this district, and these mains are supplied by high-tension feeders, each of which terminates in a transformer of the same capacity as the feeder. Pressure wires run from the mains near the terminal of each transformer back to the station. Each feeder has a regulator or booster at the station.

From this network of three-wire, single-phase, alternating-current mains current is furnished for incandescent lamps, arc lamps and motors.

There are at present about 1,000 horse-power of single-phase motors in operation, varying in sizes from one-half horse-power to 25 horse-power. Many of these have replaced direct-current, 500-volt motors, and there is not one that is not giving perfect satisfaction. Current is charged for entirely by meter.

The most novel feature of this system is the transformer and the method of making it practically a part of the feeder to which its drop is added and is cared for by the feeder regulator at the station. The pressure wires indicate the pressure on the secondary mains, which can be kept constant, however much the drop in feeder and transformer may vary.

The transformers were designed for remarkably high average efficiency, and actually show the highest efficiency at about one-quarter load. The specifications for these transformers limited the iron loss to 250 watts, the copper loss at full load to 3,200 watts, and the regulation to four per cent. Thirty of these, of 110 kilowatts capacity each, are in service on as many feeders. They all run slightly under the specified losses.

Most of these transformers have been in use for nearly a year, during which time not one has ever been out of service or shown any defect of any kind. The highest recorded load on any one was 130 kilowatts.

The feeder regulators at the station make it possible not only to regulate the pressure with the greatest precision, but to divide the load between the feeders and their transformers in any way desired. By slightly lowering the pressure on one feeder, and slightly raising it on an adjacent one, a large proportion or all of the load of the first can be transferred to the second without sensibly altering the pressure on the mains. This operation is almost identical to that of dividing the load between two direct-current generators running in parallel. All feeders can be kept almost equally loaded in this way if desired.

The method of eliminating the effect of transformer drop by making it a part of the feeder renders it possible to regulate, with a system of interconnected mains and the use of pressure wires, as closely as in a direct-current system; and the use of individual feeder regulators enables the pressure to be adjusted with the greatest precision.

The ratio of current delivered to customers as shown by customers' meters to the actual station output as shown by the station wattmeters, while not an exact measure of the distribution efficiency, owing to the losses in the customers' meters and their failure to record properly at small loads, is nevertheless a good indication for relative comparison. On the single-phase underground distribution system described, this ratio of customers' meter readings to station output reaches $86\frac{3}{10}$ per cent. The meters used on customers' premises are the most recent type of induction wattmeters. The station meters are of the Thomson recording type, and these are carefully checked by the half-hourly records of station indicating wattmeters, both being frequently calibrated. While this figure may be the highest on record it has been obtained with such great care month after month that I feel great confidence in its accuracy. The greater portion of the overhead distribution of this same company is of the usual form with individual transformers to each customer as already stated. A large portion of the current supplied in this way is used in residences, and consequently the load-factor is very low. The meters used in this work are recording ampere meters which let a considerable amount of current slip by unrecorded with light loads. The transformers are all of modern design and of high efficiency for their size. I may surprise you, however, when I state that the ratio of customers' meter readings to station output in this overhead distribution is only $48\frac{3}{10}$ per cent. I am also as positive of the the accuracy of this low figure as of that of the remarkably high one for the underground system.

The only strong argument that has ever been made against single-phase distribution is the contention that the single-phase current is not suitable for operating motors. I admit that until quite recently it has not been shown positively that motors could be operated by single-phase currents as efficiently and with as great reliability as by two or three-phase currents. For over two years, however, we have been operating single-phase motors in St. Louis with the greatest success, and we now have about 1,000 horse-power in such motors connected to our lines. As stated before these motors vary in size from one-half to 25-horse-power. The efficiency is as high as that of direct-current motors, or two or three-phase motors, and in construction they are fully as simple and free from complication. The type used for constant speed work is started and stopped by a single switch placed in any convenient location and without the use of rheostat or controller. A commutator is used to secure the required torque at starting and to bring the motor up to speed, after which it is entirely disconnected.

So far there has not been a single demand for current or energy, for any purpose for which electric current has ever been used, which we have not been able to supply efficiently from our single-phase, alternating-current mains. This experience, and the knowledge that current is required for as many different purposes in the city of St. Louis as in any other existing city, led me to state positively that single-phase currents can be used for general distribution to supply all requirements. As I have stated before, each class of current—single-phase, two-phase or three-phase—has a field of its own, and the field in which single-phase current reigns supreme is that of general distribution.

*Abstract of a paper read before the National Electric Light Association, New York, May 24, 1899.

ALTERNATING-CURRENT GENERATION AND DISTRIBUTION.*

BY H. M. ATKINSON.

(Concluded from page 339.)

Our general plan is to send the electrical output to the distributing wires—whether for direct-current series, alternating-current arcs, direct-current series arcs or any other kind of business—from large generating units of similar design and type working in multiple, and that by doing so we shall have lower expense per kilowatt than with smaller units, and certainly as great flexibility as we had with our shaft, as our source of current is brought to one spot and that direct-connected to the steam power.

There are three main questions of policy to be settled before we can do anything:

1. Periodicity. 2. Voltage. 3. Phase of generator.

Taking up the question of periodicity, our field presents the possibility of a very large motor business. Our plan contemplates the use of single generating units for both motors and lights. The lighting will fix the low limit of cycles, consequently we must use as low a cycle as possible for the best accommodation of our power business, but still high enough to handle our lighting service satisfactorily. The manufacturers have chosen 60 as their standard. All the leading manufacturers build machinery and apparatus of this cycle, which is an added reason for selecting 60. Special machinery is objectionable on many accounts.

Next comes the question of primary voltage. Our lighting center is not over one mile from our station, and will probably not be over a mile and one-half to our most distant motor. Should work in time develop at greater distances, step-up transformers could be used in case the line losses shall figure greater than the transformer losses; therefore, we shall use 2,300 volts for the primary voltage.

Next we come to the phase of generator.

A generator well adapted for power business must be two or more phase. Two-phase is simple, if all phases are distributed on streets for lighting only. Three-phase requires less copper for motor work. It is our intention to run lights from each phase in different sections of the city, and we must be prepared to run motors of any power from all three phases

We anticipate that the development of our business will almost certainly require a constantly increasing amount of power for motor work. This being the case it seems best to employ the form of generator that is most economical in copper cost for motor distribution. This feature of our business has influenced us largely in our decision for three-phase generators. We intend to take the three primaries to our larger motors and to use induction regulators on each of two phases, regulating the third phase by the machine voltage and keeping this just right for the three-wire network that carries three-quarters of our incandescent lighting load.

Our street lighting at present consists of the equivalent of 870 9 6 ampere series arc street lights and 70 commercials Our plan contemplates ultimately taking these lights off of three-phase generating units, either on the motor plan, using induction or synchronous motors and large arc machines, or "tubs" and series alternating arcs.

We shall use as large transformers as possible on each phase, keeping the number down to a minimum, and they will feed into our three-wire network. These transformers will be placed underground in the central section of the city, and as the load drops off, we intend that our "trouble-man," who is constantly on duty at our office within this district night and day, shall cut off unnecessary transformers This will save the loss on such transformers, as we are able to cut out for a large part of the 24 hours.

We hope to use single-phase motors of one-horse-power and less. For heavy power work we intend to use induction motors.

If we find it necessary, as we anticipate we may, to continue and perhaps increase our 5 0-volt power circuit, we can use in this connection a rotary transformer.

The success of our plan will, of course, depend upon the care with which the engineering work in both the steam and electrical ends is carried out. The bulk of our incandescent lighting and power business is concentrated within a one-half-mile circle. We think that within a reasonable time this business can be doubled.

We think our plan, as outlined in the foregoing, will accomplish the following results:

1. We shall have large and few units, which means economy in steam and steam attendance.

2. We shall have multiple running, which means even service and the highest efficiency in engines and generators, by keeping as nearly a full load as possible at all times.

3. By using motors to drive our arc machines, attendance will be cut down and saving effected in repairs, belting losses and losses in shafting; or should we decide on "tubs" and series alternating arcs, we shall have all the foregoing and the additional advantages of steadiness, reliability, less attendance and higher efficiency.

4. Our incandescent customers will be served as perfectly as with a single phase plant.

5. If we have to continue our 500-volt motor circuit for some classes of work, it can readily be run from rotaries, and so increase the day load on our generating units.

To summarize, we have accomplished the following:

1 Large units in steam and generators. 2 Current for any purpose from these generators 3. High steam economy. 4. High generator efficiency. 5. What we believe to be the most perfect system of alternating distribution.

It is extremely hard to face such radical changes in a company that is to-day a success, but the rapid growth of our business forces us to act, and but for this growth we should undoubtedly go along as we are.

(Discussion to follow.)

*Abstract of a paper read before the National Electric Light Association, New York, May 25, 1899.

Senator Clark on the Copper Situation.

Senator W. A. Clark, of Montana, has returned from Europe quite recently and is temporarily in New York. The *Wall Street Journal* asked him a few things about the copper situation, especially as to the reported existence of a copper trust, and he replied:

"There is nothing existing to-day in the way of a copper trust that I am aware of. Neither is there any combination amongst producers of copper for the purpose of maintaining or advancing prices. It is true that there has been a consolidation of some large copper interests, notably at Butte, Mont., but this does not include, so far as I know, some of the greatest copper producing companies in the world, to wit: the Calumet & Hecla and some other large interests in Lake Superior, the Copper Queen and United Verde copper companies in Arizona, the Rio Tinto and Tharsis in Spain, and even at Butte there are other large interests not comprised in the Amalgamated Copper.

"The apparently high price of copper is the result of the inevitable law of supply and demand. For several years the visible supply of copper in the world has been greatly diminishing and while the world's production of copper has been increasing at the rate of about 10 per cent per annum, it has been undoubtedly to meet the demands of consumption, hence the rise in values.

"What is termed the available supply of copper in the world is reckoned as about 26,000 English tons. This is to some extent represented by copper afloat and in store in the districts where it is produced so that the actual available supply is only about 15,000 tons—about enough to cover the consumption for 15 days. How long this condition of things will continue it is hard for any one to predict. I know of no new large bodies of copper ore that have been discovered and it requires about two years to open up and equip a new mine so that it becomes an important factor. Hence, it would seem that the price which may be expected to rule in the future will depend largely upon the rate of consumption. Increased consumption has been to a large extent due to electrical equipment. The installation of street railways has been an important factor in this matter. It is supposed that this will be largely extended in Europe where in some localities at least it has scarcely commenced."

When asked as to the probability of some other metal taking the place of copper, Senator Clark says:

"There is no metal that will serve the purposes to which copper is applied that possesses the requisite qualities of ductility and conductivity. Experiments have been made with aluminum, but I do not believe they are satisfactory; besides, the cost of the metal is more than double that of copper."

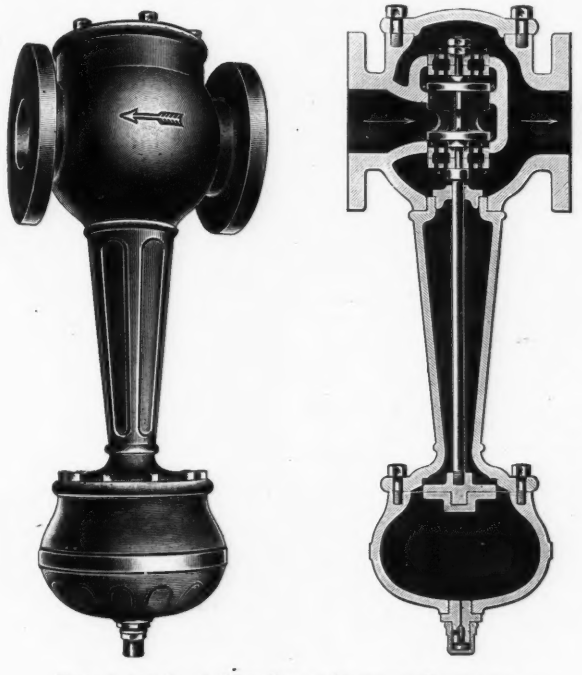
When asked whether he had any connection with the new copper companies incorporated under the name of Verde in Arizona, Senator Clark said:

"One of these so-called Verde companies is operating about 140 miles from the United Verde Copper Company's mines, but I know nothing about it from personal observation. The other two are, I believe, in the vicinity of Jerome, Ariz., and near the United Verde Copper Company's mines. I have never heard of their having produced a carload of ore. There is always a tendency to play upon the reputation of well-known names and sometimes at the expense of the public who are deceived thereby."

A sporting paper thinks that wireless telegraphy, if successful, will be a boon to the proprietors of pool rooms, inasmuch as the wire-tappers will then be powerless.

A New Steam-Pressure Regulator.

A new pressure regulator or reducing valve, illustrated herewith, is about to be placed on the market by the D'Esté & Seeley Company, of Boston, well known manufacturers of steam specialties. This new regulator is novel in its construction and, the makers state, wonderfully accurate in its operation. The principal novelty in its construction is the use of air for a spring instead of metal springs or levers and weights. The manufacturers have applied the muffler principle to this regulator and have succeeded, it is claimed, in making a perfectly noiseless device.



FIGS. 1 AND 2.—A NEW STEAM-PRESSURE REGULATOR.

As shown in the illustration the air-spring is formed in an air-tight chamber, of which the diaphragm (which carries the main valve) forms one side. With a bicycle pump, air is pumped into this chamber, and its pressure on the diaphragm pushes the valve open, and holds it open until the low pressure on the opposite side of the diaphragm forces it to its seat. It is thus seen that any high pressure is reached by simply pumping into the chamber, and any lower pressure, by letting air out of the chamber, while the air itself forms a singularly elastic and perfect spring, fully supporting every part of the surface of the diaphragm on one side, against the equal pressure of the fluid on the other side. The diaphram is simply an elastic partition between two equal pressures. The purposes to which this regulator may be applied are as various as the wants of steam users. In electric light or railway plants the regulators are used to reduce a varying, unsteady boiler pressure to a uniform pressure, incidentally re evaporating any entrained water, and giving dry steam to the cylinders.

An Automobile Exhibition in Berlin.

The committee of the automobile exhibition, to be held in Berlin next September, made a trial of a motor omnibus recently. The course, about two miles in length, was from the Reichstag Hall to the Charlottenburg, and the run occupied 25 minutes. The omnibus is driven by two motors, which work by means of cogwheel gear on the hind wheels, and are fed by electricity. The carriage, which is built like a street-railway car, has 12 seats and standing room for six persons at the back. The front part is reserved for the sole use of the driver. The accumulators, like those on the electric cars, are fixed under the seats, and have a capacity sufficient for 20 kilometres. They can be automatically recharged at fixed intervals. The carriage is steered by a handle, easily worked with one hand; and is also provided with a mechanical fly brake and an electric brake. The electric brake brings the carriage to a standstill in 1.5 metre's space when going at full speed. The weight of the carriage is 3.500 kilogrammes. It costs about 15,000 marks. The directors of the traffic company state that the company hopes to have these motor cars ready in September. The omnibus tested stood the trial well.

The American Electro-Therapeutic Association.

The coming meeting of the American Electro-Therapeutic Association, to be held in Washington, D. C., September 19, 20 and 21, will bring together those, in this country, most interested in electro-therapeutics. The headquarters will be at Willard's Hotel.

For the use of exhibitors Willard's Hall has been secured. This hall immediately adjoins the hotel and may be entered either from the hotel or from F street. The dimensions are 40 by 50 feet, and it is proposed to subdivide the floor space by three aisles, leaving exhibition spaces six feet deep by such length as individual exhibitors may desire.

All possible arrangements have been made for the convenience of exhibitors, including electric current, either direct or alternating. A charge will be made for space, application for which should be made to Clifton Mayfield, M. D., 1335 Thirtieth street, N. W., Washington, D. C.

ADVANCE INFORMATION

New Telephone and Telegraph Companies.

PORTSMOUTH, OHIO—The Portsmouth Telephone Company has been granted a franchise by the City Council. It is capitalized at $50,000 and will act in co operation with the independent telephone company that is planning a line from Sandusky to this city via Marion, Delaware, Columbus, Circleville and Chillicothe.

WASHINGTON, PA.—The American Telephone Company, capitalized at $1 000, has been chartered to build a telephone line in the counties of Allegheny, Westmoreland, Washington, Beaver, Lawrence, Butler and Armstrong.

LITTLE ROCK, ARK.—The Osceola Telephone Company has been incorporated; capital stock, $2,500; incorporators, T. G. Brewer, Will J. Driver, R. E. Fletcher, C. H. Gaylord, J. P. Keiser, L. A. Palmer, S. S. Semmes and G. W. Thompson.

COLLINWOOD, OHIO—The Collinwood Home Telephone Company has been incorporated; capital, $25.000; incorporators, W. G. Patten, J. B. Wood, J. B. Durkin, J. M. Hard and E. L. Barber.

WILMINGTON, DEL.—The Delmarvia Telephone Company will extend its lines to the state boundary, to connect with the Delaware County Telephone Company, of Chester.

WEAKLEY, TENN.—A charter has been granted to the Weakley County Telephone Company with $10,000 capital stock; incorporators, Messrs. J. H. Wilson, G. W. Hall, W. T. Lawler, G. E. Bowden, T. M. Ryan, J. M. Gardner, J. E. Kennedy and J. T. Jetter.

NASHVILLE, TENN.—The Secretary of State has granted a charter to the Whitesburg & Romeo Telephone Company, with $900 capital stock. The line will extend from Whitesburg, in Hamblen County via Rogersville, in Hawkins County, to Romeo, in Green County.

HARRISBURG, PA.—A new electric railway is being surveyed to connect Singlestown, via Paxtonia, with Harrisburgh, Pa. The company proposes to install a power plant.

New Incorporations.

TIVERTON, R. I.—The Tiverton Electric Light Company has been incorporated to deal in electricity, electrical instruments, etc.; capital, $100,000; incorporators, J. R. Hicks, Fall River, Mass.; G. R. Lawton, R. J. Barker, J. H. Wilcox, R. J. Barker, Jr., all of Tiverton.

NORWALK, CT. — The Norwalk Heating and Lighting Company has been incorporated to manufacture machines for the production of light and heat; capital, $60,000; incorporators, J. D. Kinney, M. H. Glover, F. I. Jones, W. R. Maples, J. W. Maples, all of Norwalk.

PORTLAND, ME.—The Runnels Car Defender Company has been incorporated, with $100,000 capital stock. The directors are Eugene W. Hunt, Harry B. Russ and A. E. Cushing, all of Portland. The clerk and treasurer is Eugene W. Hunt, and the president is Harry B. Russ.

PORTLAND, ME. — The United States Electric Signal Company has been organized at this place for the manufacture of electric signals, with $50.000 capital stock, of which $70 is paid in. The officers are: President, W. H. Rand, of West Newton, Mass.; treasurer, J. H. Nickerson, of West Newton, Mass.

NILES, OHIO—The Niles Electric Company has been incorporated; capital, $20,000; incorporators, E. A. Wilson, F. E. Wilson, Mrs. Nancy Wilson, Etta M. Wilson, Emma W. Wilson, all of Niles.

NEW YORK, N. Y.—The Electric Lead Reduction Company has been incorporated; capital stock, $12,000,000.

PHILADELPHIA, PA.—The Speer Carbon Company has been incorporated, with an estimated capital stock of $200,000, to engage in the manufacture of electrical supplies, particularly of carbon for electric lights, motor and generator brushes.

SOUTH BEND, IND.—The Edison Electric Company has been incorporated; capital, $100,000; directors, Otto Knoblock, George A. Baker and Albert Morrell.

MISSOULA, MONT.—The Montana Water, Electric Power and Mining Company has been incorporated, with a capital stock of $500,000. The company proposes to acquire and develop water-power, operate mines, carry on a general commercial business in the state of Montana.

Electric Light and Power.

TROY, N. Y.—The Granville Electric Light and Power Company has been incorporated with the Secretary of State. The capital is $80,000, and the directors are Eugene R. Horton, Emmett W. Wyman, of Granville.

BALTIMORE, MD.—The Atlantic Electric Company, of this city, has been awarded a contract by the Maryland Amusement Company to install a system of electric lighting at Deer Park and Woodside Park, which will include 5,000 lights in each place.

CHICAGO, ILL.—The Dearborn Power Company has been incorporated; capital. $25,000; incorporators, H. Holmes, C. F. Hart, J. K. Green.

PATERSON, N. J.—The Hackensack Gas and Electric Company has absorbed the lighting companies of Englewood, Rutherford and Ridgewood. The consolidated company is to be known as the Gas and Electric Company, of Bergen County. It has $2,000,000 capital. Frank B. Poor will be president.

BURLINGTON, IOWA—The Burlington Improvement Company has decided to improve its lighting and heating properties in Davenport to the extent of $40,000, including the laying of eight miles of gas mains.

DURANGO, COLO.—A franchise has been granted to the Durango Electric Light Company. The plant is to be erected by Denver, Durango and Baltimore capitalists at an expense of $75,000, and will be modern in every particular. The franchise provides that illuminating gas shall be furnished at a cost not to exceed $1.50 per 1,000 cubic feet and 80 cents per 1,000 cubic feet for fuel gas. J. B. Airy, Harry Jackson, W. G. White and C. C. Eddy are the Durango members of the company.

New Electric Railways.

CHESTER, PA.—The West Chester, Kennett & Wilmington Electric Railway Company has been incorporated to build an electric line eight miles long. The company is capitalized at $50,000, with Geo. W. Taft, of Kennett Square, as president.

JAMAICA, L.I.—The Cross Country Railroad has been incorporated, with a capital of $250,000, to construct a trolley line 15 miles in length from Willets Point and College Point through Flushing and Dunham street, South road, and Liberty avenue, Jamaica, to the Brooklyn city line. The directors are James McLean, Andrew A. Halsey, Theodore Bernard, George Keller, James Crowley, Francis Bacon, James Erwin and Charles Brandon, all of Brooklyn.

JAMAICA, L. I.—The Brooklyn & Jamaica Bay Turnpike Company has been incorporated to construct a causeway across Jamaica Bay. Its capital is $100,000, and the directors are Joseph F. McLean, Andrew A. Halsey, Theodore Bernard, Charles H. Kelley and George Kellar. The causeway is to be constructed across Jamaica Bay from Rockaway Beach to a point in the town of Jamaica, near Old Mill Creek, a distance of four miles. The line will then be continued to Liberty avenue at the terminus of the Kings County Railroad.

BETHLEHEM, PA.—The Bethlehem Construction Company are prepared to receive bids for the grading and laying of the track, erecting poles and string wires for the electric road running between Bethlehem and Nazareth. The plans and specifications can be seen at the office of the company, Globe Building, Bethlehem, Pa. Bids will be received up to three o'clock, Monday, June 12, 1899.

Increase of Capital.

CHICAGO, ILL.—The Compressed Air Motor Company has certified to an increase in capital stock from $1,000,000 to $1,250,000.

ALBION, N. Y.—The stock of the Albion Power Company has been increased from $50,000 to $75,000.

Suggestions for Electrical Paper Advertisers

Advertisers should discriminate and not judge of trade advertising generally by their experience outside of papers of the first class.

Failure to use up-to-date methods reduces the value of trade advertising to a minimum.

The art of advertising is to talk to a hundred or ten thousand buyers just as you would talk to one buyer in your own office.

There is no adequate channel through which to reach the distributor except the first-class trade paper.

All advertising is aimed ultimately at the consumer. Trade advertising is a first-class way of reaching the latter.

One trade paper may affect the buying of many times more consumers than the largest general medium.

The soundness of the policy of trade advertising is attested by its constant extension.

The first-class trade paper is the best adviser of the general advertisers among its own trade.

(From a recent Sphinx Club paper read by Mr. Chas. T. Root, of New York.)